

Refuge Notebook

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Missing the missing snow

by Andy Loranger



The morning sun on the last day of 2014 shows the sheen of water and ice on Headquarters Lake, a time of year in which the Kenai Peninsula would normally be blanketed in snow.

Short days and little to no snow—not a pleasant combination for most Alaskans who treasure their winter outdoor recreational pursuits. A recent news story about Anchorage temperatures not dipping below zero degrees Fahrenheit in 2014 was yet another reminder, as if we needed one, that winter has been strangely absent since last December here on the Kenai National Wildlife Refuge. Snow has been among the casualties.

In addition to supporting our winter past times, snow and snow cover in the northern latitudes are of course transformative agents with far-reaching ecological effects.

Snow itself provides habitat for some primitive forms of life. This includes surprisingly abundant and diverse communities of algae, bacteria, fungi, diatoms, viruses, rotifers and tardigrades. Snow also accumulates debris and chemicals including plant nutrients and pollutants from the atmosphere. Some, like atmospheric nitrogen, are then released and redistributed across the landscape. For example, snow melt provides an important source of nitrogen in tundra ecosystems.

Snow plays a dual role in terms of temperature regulation. Fresh snow has a high albedo, meaning it reflects almost all solar radiation. Snow also acts

as a heat sink, removing energy from the atmosphere in the form of heat. This means that the presence of snow cover inhibits soil warming until it melts, preventing biological activity that requires temperatures above freezing.

Conversely, snow is an efficient insulator, keeping temperatures in the subnivean environment (“beneath the snow”) stable at close to 32 degrees Fahrenheit. Water content, or density, is critical in determining the insulative properties of snow. Wet snow is less dense and provides less insulation. A layer of 6-8 inches of dry snow, comprised of billions of crystals separated by tiny air pockets, provides enough insulation to protect ground-level life from sub-zero ambient temperatures.

Plants covered by snow are protected from drying out in the winter and from erosion of their tissues by ice crystals. The subnivean environment is also very humid, and under thin snow packs in spring, light can penetrate and permit limited photosynthesis for some lichens and evergreen shrubs. Plants experiencing this “greenhouse effect” can begin to grow weeks before their neighbors covered by deeper snow. This combination of moisture and light beneath the snow allows for an important adaptation in a land of short growing seasons.

Warmed by radiant heat from the earth, gaps open between the snow and the ground. Many small mammals such as voles and shrews, as well as their predators like ermine, remain active throughout winter in this subnivean space. Resident birds also use subnivean spaces for protection against cold. Redpolls and chickadees often congregate beneath the snow, maintaining precious body heat. Larger birds including ptarmigan and grouse will submerge their bodies in snow to insulate themselves.

Recent discoveries have shed light on the activity of microbes—vast mats of fungi and bacteria—which thrive in soils beneath insulating layers of snow. Researchers have found that winter is a time of great microbial activity in soils that affects a very delicate balance between release of carbon dioxide through transpiration and nitrogen fixing important to plant growth and carbon storage. The timing of the

snowpack—when it comes and goes—is believed critical to this balance.

Here's hoping that 2015 brings with it a return of at least average snowfall here on the Kenai Peninsula! From the entire Refuge staff, best wishes to all of you for a peaceful and joyful holiday season.

Andy Loranger is the Refuge Manager of the Kenai National Wildlife Refuge. You can find more information about the refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Celebrating marmots

by John Morton



Hoary marmots live near treeline in the Kenai Mountains.

For those of you who don't know it, Marmot Day is on February 2. Celebrated in many lower 48 states as Groundhog Day, the name change was recognized by the 26th Alaska State Legislature as an official holiday. Who'd have guessed that North America's biggest squirrel and perhaps one of the laziest (hibernates 8 months of the year) would become so famous?

In a strange twisted way, this all makes sense. There are marmot researchers who call themselves marmoteers and marmot fans who call themselves marmotophiles.

A groundhog is in fact a marmot, one of 15 species found in the northern hemisphere worldwide. In Alaska, there are three marmots, the Alaska or Brower's marmot which is restricted to the Brooks Range, the woodchuck (or groundhog) which is restricted to the eastern interior north of the Alaska Range, and the hoary marmot which is found in many alpine habitats south of the Yukon River including our Kenai Mountains.

Hoary marmots (*Marmota caligata*), sometimes called "tundra bears", are mostly gray with a darker lower back and face and a dark, reddish tail. They have a white patch between their eyes. They have well-developed claws on their front feet for burrowing with 5 pats on their forepaws and 6 on their hind

paws. *Caligata*, which means "booted" in Latin, comes from their black feet. Their pelage color is adapted to help them blend with the surrounding lichen-colored rocks or rusty-brown soil.

There are two likely endemic subspecies of hoary marmots in Alaska. Montague Island marmots were last seen at the turn of the 20th century and may be extinct or close to extinction. Glacier Bay marmots are melanistic (black) and are also presumed to be an endemic population. Given the Kenai Peninsula's insularity and glacial history, and the poor dispersal ability of marmots, it wouldn't surprise me if our own hoary marmots were genetically unique.

Adult hoary marmots can weigh more than 10 pounds by late summer and exceed 30 inches in total length. Not surprisingly, wolverines, wolves, bears and eagles prey on them. The Alaska Department of Fish and Game considers the marmot a furbearer and so trapping regulations apply to harvest by humans. Indeed, hoary marmot hides were prized by northwestern Native Americans, used for clothing, in potlatch ceremonies and as a sort of currency among the Tlingit.

Hoary marmots are highly social animals, communicating by whistling, nose rubs, and tail movements. The basic social structure of a marmot colony consists of one adult male, one satellite male, one or more adult females, two-year-olds, yearlings, and young of the year. They can live for up to 15 years. Mating occurs once per year in early spring, often while still in the den. Females give birth every other year to litters of 3-8 young in late spring to early summer after a 4-week gestation period.

True hibernators, hoary marmots enter a state of torpor in winter during which body temperature and all bodily functions are reduced. They hibernate in the same burrows in which they spent the summer. Remember, these guys are the champions of hibernation, spending 8 months in a partially-suspended state. They emerge in mid-May, become lethargic by late August, and re-enter the burrows as early as early September. All members of family groups hibernate together.

I was intrigued to run across an online abstract

in the Journal of the American Medical Association of a study on hibernation and marmot physiology conducted by Carnegie Institute researchers in the 1930s. They found the basal metabolism of even non-hibernating marmots was lower than that of other warm-blooded animals of comparable size.

What do hoary marmots eat? One of the best studies of their diet was conducted by a Colorado State University researcher who analyzed marmot scat collected from Slaughter, Surprise and Crescent mountains near Cooper Landing in the early 1970s. More than 90% of their diet was plants, composed of vetches, dryas, sedges, fleabanes, fescue grass, mosses, lichens, and willows. But they will eat meat when given the chance. Hoary marmots, introduced in the 1930s to Sud Island, the smallest of the Barren Islands between the Kenai Peninsula and Kodiak, nearly wiped out the native rhino auklet population by eating its eggs.

Here on the Kenai Peninsula, hoary marmots live near treeline. Relatively accessible places to find them are along the trails to Exit Glacier in Kenai Fjords National Park and Summit Pass in Chugach National Forest.

However, treeline has risen 50 meters on average

in the Kenai Mountains in the past 50 years due to a warming climate. While that doesn't sound like a lot, it represents about 300,000 acres of alpine habitat lost. Furthermore, hoary marmots have a narrow climate niche—they're heat intolerant in summer, require insulative snow during winter, but need a rapid snowmelt in spring so they can get busy with their short reproductive season. As such, hoary marmots are good candidates as indicator species of climate change. Long-term population dynamics of hoary marmots may also indicate changes in alpine snow-pack, plant phenology and abundance, or predators.

Biologists at the Kenai National Wildlife Refuge are planning on surveying the distribution of marmot colonies over the next couple of years to assess their current status. For any local marmotophiles out there, we ask your help in finding colonies. Please call 907-260-2815 or email me at john_m_morton@fws.gov if you have sightings or anecdotal observations to share.

Dr. John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information about the Refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Kenai Refuge fire management officer heads out to new adventures

by Kristi Bulock



Now-retired Doug Newbould stands next to his fire management vehicle.

After 17 years of service, Doug Newbould retired from the Kenai National Wildlife Refuge. The refuge will feel this loss as Doug has contributed substantially to the management of the fire program and multiple wildfires over the years. But Doug has been a firefighter for much longer than this...

Doug learned to be a firefighter on Bridger-Teton National Forest in Wyoming where he earned his first "red card" (wildland firefighter credential) in 1976. He then moved to White River National Forest where he implemented cooperative prescribed fire projects with the Colorado Division of Wildlife. This is where Doug really "cut his eyeteeth" with fire leadership and developed skills in the application of fire to reduce hazardous fuels and to improve habitat. In 1988, Doug utilized these skills in the well-known Yellowstone fires alongside 9,000 firefighters and 4,000 military personnel.

In 1991, Doug and his wife Denise moved to Kasilof after accepting a timber staff position with Chugach National Forest. While working for the Seward District, he continued to hone skills with vegetation management, mainly through timber salvage sales associated with beetle-killed trees, while also serving as a firefighter. In 1992, the Newboulds purchased their current home in Soldotna where they raised their two children.

Doug was always enthralled with the beauty of Kenai Refuge so he was pretty excited when he got the job here as Assistant Fire Management Officer in 1997. This position was created because fire management was becoming increasingly more complex. In recent decades the Kenai Peninsula had witnessed a warmer and drier climate which triggered a spruce bark beetle epidemic, converting some areas to very flammable grasses, and increased the frequency of

lightning storms and natural ignitions. Doug became the Kenai Refuge Fire Management Officer a year later when the incumbent retired. In the early 2000s, fire management on Kodiak Refuge was added to Doug's duties.

A landmark wildfire season across the U.S. in the late 1990s brought about development of the National Fire Plan. This plan largely focused on hazardous fuel reduction as a means to mitigate severe wildfire risks to communities and natural resources. Fuels are reduced through mechanical treatments or prescribed fire, or by allowing naturally occurring fires to restore fire-adapted ecosystems.

This plan, along with a local Moose Management Plan, provided the framework for completing fuels reduction projects on and adjacent to the refuge. In 1998, Doug spearheaded the design and initiation of the Funny River Road shaded fuel break. Later, prescribed fire was his primary tool for reducing hazardous fuels at Mystery Creek, an effort to reduce the potential of fire moving toward Sterling from refuge lands to the east.

Doug and his staff completed over 1,550 acres of prescribed fire treatments by 2002. That same year, the Lily Lake project was developed in an area of continuous stands of black spruce to create an additional wildfire buffer in the Wildland Urban Interface (WUI), the area where refuge lands are in close proximity to homes.

Along with hazardous fuels treatments, Doug feels that some of his biggest accomplishments on the refuge involved cooperatively managing wildland fires for resource benefits as a Strategic Operational Planner. His list includes Pipe Creek, Fox Creek, Irish Channel, King County Creek, Swan Lake, and Shanta Creek fires. The post-fire effects proved useful in later years to reduce wildland fire intensity, create barriers to wildfire spread, and help restore ecosystems that rely on fire as a disturbance mechanism. In fact, many of these fire scars have played a role in how future fires were able to be managed on the refuge.

Last spring the extremely dry weather and cured grass coupled with strong winds promoted fast growth of the Funny River Fire within a relatively short time period. Many agencies were brought together to assist

on this human-caused fire, including resources from the lower 48. Hazardous fuel reductions on the north side of the fire altered fire behavior enough to allow firefighters to safely work and contain fire spread. Additionally, fire scars from the Shanta Creek and King County Creek fires assisted in reducing the intensity and spread of the fire.

The Funny River fire served as a reminder that living with fire is part of living where we do, but the risks can be mitigated by implementing hazardous fuels reductions and applying other "Firewise Principles" to our homes.

Doug says the best part of working at the Kenai Refuge is "the people" — working with refuge staff, multiple agency cooperators, and the community provided great job satisfaction. Within the larger interagency wildland fire community, Doug served on the Alaska Air Quality Committee and also as a charter member of the National Fire Operations Safety Team. Locally, Doug served on the Kenai Peninsula Fire Chiefs Association, the Local Emergency Planning Committee, and the All Hands/All Lands interagency working group. Under the leadership of the Kenai Peninsula Borough, the All Hands/All Lands group works with communities and their Fire Chiefs to complete Community Wildland Fire Protection Plans (CWPPs). Doug served as a federal advisor during the formulation and implementation of multiple CWPPs for communities adjacent to the refuge. Doug stated, "this is my home and I intended to defend it that way," while he served as the Fire Management Officer.

Doug feels that the Kenai Refuge is a spectacular public resource with a great mission. He usually meets his goal of getting out on the refuge canoe system at least once a year, but also enjoys the backcountry alpine areas. Doug has had a great career in some of the most beautiful places in the country, but when asked what is next, he says he is ready to enjoy and explore Alaska with Denise, especially its coastal waters. His last words: "we love the Kenai, it's our home and we plan to stay involved in our community."

Kristi Bullock is the new Fire Management Officer at Kenai National Wildlife Refuge. Find more information about the refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

What do caribou and wood bison have in common?

by Nate Olson



Residents from the village of Shageluk on the Innoko River assist ADFG and USFWS staff in constructing a holding pen as part of the wood bison reintroduction effort. 100 wood bison are scheduled to be released on the lower Innoko River in March 2015. Photo credit: Tom Seaton, ADFG.

Last weekend on a drive back from Anchorage, whizzing by the Alaska Wildlife Conservation Center at 57 miles per hour my daughter pointed out a strange looking moose on the side of the Seward Highway. “That isn’t a moose,” I explained, “that is a wood bison.”

And why are wood bison living in pens next to the Seward Highway? They are part of a reintroduction effort by the Alaska Department of Fish and Game (ADFG) and the Alaska Wildlife Conservation Center. The fate of these wood bison has been in the news lately as the U.S. Fish and Wildlife Service (USFWS) published a final rule in May 2014 that gives the green light to the reintroduction of a “non-essential experimental” population in interior Alaska scheduled for March 2015.

Wood bison are native to Alaska and were plentiful over a large portion of the state until their extirpation in the early 1900s. The reasons for their disappearance are not clearly known but probably related to overharvest and habitat loss.

Wildlife transplants are nothing new in Alaska. The reasons for transplanting animals generally fall into two categories. The first is to provide human related benefits such as recreational hunting, economic gain, or an additional food supply. The second is related to species recovery in their historic range.

Kodiak Island is a dramatic example of the first category. With the exception of the brown bear, the island had very few native mammals as a result of its glacial history. Sitka black-tailed deer, mountain goats, Roosevelt elk, reindeer, beaver, red squirrel,

snowshoe hare and American marten have all been introduced within the last century, none of which are native to Kodiak.

Wood bison fall into the second category, as do caribou on the Kenai Peninsula. Historically, caribou were abundant on the Kenai Peninsula, but were completely wiped out in the early 1900s. The cause of their extirpation is unclear but likely due to a combination of human-caused fires that destroyed winter habitat and market hunting in the late 1800s. The last 13 caribou on the peninsula were shot in 1912 near Ptarmigan Head in the Caribou Hills.

A joint USFWS-ADFG plan was hatched to restore caribou to the peninsula after a 1952 USFWS assessment concluded that range conditions could again support caribou. In May 1965, 15 caribou from the Nelchina herd were released on the former Kenai National Moose Range between Chickaloon River and Mystery Creek. This seed population became the Kenai Mountain herd which now ranges over Chickaloon River, Big Indian Creek and Resurrection Creek.

To augment that first transplant effort, another 29 caribou from the Nelchina herd were released at Watson Lake near Sterling in April 1966. These caribou became the Kenai Lowlands herd that ranges in and around Sterling, Kenai and Soldotna. Although the 1965-66 introductions were successful, the two principal historic caribou ranges on the Kenai, the Caribou Hills and Skilak-Tustumena Benchlands, were still caribou-free.

So in April 1985, 28 caribou from the Nelchina herd were released near Glacier Creek. In April 1986, 18 caribou each were released at both Emma and Green Lakes in the Kenai National Wildlife Refuge, and 16 caribou at Caribou Lake in the Caribou Hills. From this second series of transplants emerged the Killey River, Twin Lakes and Fox River herds. The Twin Lakes herd subsequently merged with the Killey River herd in 2002.

Although caribou didn't re-occupy Caribou Hills, caribou reintroduction on the Kenai Peninsula is considered a success. The Killey River, Kenai Mountain and Fox River herds provide hunting opportunities,

and the Kenai Lowland herd provides wildlife viewing opportunities for residents and tourists during several months of the year.

As you can probably tell by looking outside, this winter is quite a departure from the norm. In fact, for the last two winters, we have seen very unusual warm temperatures and little snowfall. This recent spike is part of a longer warming and drying trend that began in earnest in the late 1970s. Average January temperatures at the Kenai Airport have increased 7 degrees since 1977!

Climate envelope models, mirroring field data, forecast dramatic vegetation changes on the peninsula. Spruce bark beetle-killed forests on the southern peninsula show strong signals of grassland conversion. Alpine tundra in the Kenai Mountains show strong signals of upslope forest (white spruce and hemlock) and shrub conversion.

Perhaps we should begin thinking of adding another category to our list of reasons for transplanting animals. What about introducing species adapted to a warmer climate or "keystone" species that can help shape a changing ecosystem?

For example, although there is no evidence that wood bison ever occupied the Kenai, it wasn't so long ago that steppe bison roamed Caribou Hills (see previous Refuge Notebooks articles by Dawn Magness and Dick Reger). If ecosystems continue changing as predicted, bison introduction to the peninsula might be up for discussion. But don't hold your breath as a number of legal issues would need addressing to introduce new species to the Kenai Refuge, especially within Congressionally-designated wilderness.

Time will tell if climate trajectories will continue as predicted and whether our views on managing wildlife populations change accordingly. But for now it seems that the wood bison will once again roam free within a small portion of their historic range.

Nathan Olson is the wildlife biologist-pilot at Kenai National Wildlife Refuge. Find more information about the refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Futuristic method to identify insects becomes reality

by Matt Bowser



A fourteen-spotted lady beetle from Headquarters Lake, one of the species identified in samples processed by next-generation sequencing methods. Photo credit: Matt Bowser/USFWS.

Last week I actually lost sleep in excitement over receipt of our first set of “next-generation sequencing” data, our latest step in a years-long effort to overcome the taxonomic impediment. Yes, I am pretty nerdy, but this is my bread and butter.

As an entomologist, I was hired at the Kenai National Wildlife Refuge mainly to deal with this taxonomic impediment. Taxonomy, in the biological sense, is the grouping of living things based on shared characteristics as well as putting names on those groups. For many living things, assigning meaningful names to them is not easy. This difficulty and the barriers to overcoming it are referred to as the taxonomic impediment.

For example, in the summer of 2013, a Homer resident brought me several small, leaf-rolling moths that had been damaging her apple trees. I am no expert

on small moths, so I promptly pinned them up and mailed them to a lepidopterist colleague. He sent them to a second lepidopterist who was able to assign them to the correct genus. They were then forwarded to a specialist on this group, who determined that they belonged to a new species to science, previously undescribed. I received this news a few days ago, well over a year after the moths had been brought to me, and still they will likely not receive an official name for a few years yet.

Similarly, it took considerable time, effort, and expertise to correctly determine that the sawfly contributing to decline of thin-leaf alder on the Kenai was the green alder sawfly, an exotic species from the Old World.

In these cases, the importance of knowing the identities of a potentially new pest of apple trees and an unfamiliar sawfly decimating our streamside alders justified the costs of correctly identifying them. We cannot afford to expend this much effort on routine identifications.

In recent years, the cost of identifications using DNA barcoding has come down to about \$11 per specimen. Classical DNA barcoding is the sequencing of a short, standardized region of the genome for the purpose of species identification. Compared to identifications using morphology, DNA barcoding is well suited to immature, fragmentary, or even partially digested specimens that cannot be identified by conventional means. Even at \$11, though, the cost becomes prohibitive when a single sample collected in the field may contain hundreds or thousands of insects, and all of the specimens must still be handled individually.

Within the last decade, “next-generation sequencing” (NGS) platforms have become available, hardware that can quickly sequence thousands of different strands of DNA simultaneously, potentially enabling thousands of identifications from a single mixed sample. What we’re talking about here is taking a single collection of insects, say from a sweep-net, grinding them up for analysis, and getting back a list of DNA barcodes that potentially represent all the species in that sample. However, making sense of the astounding quantities of sequences generated by these meth-

ods requires a reference library of DNA barcode sequences obtained by classical DNA barcoding of identified specimens.

For years now we have been building a reference library of DNA barcodes of insects from the Kenai Refuge with the express purpose of enabling identifications using NGS methods. Now that the cost of NGS processing has come down from nearly \$1000 to less than \$100 per sample, we recently submitted three insect-filled vials to an NGS lab as a trial.

The three samples yielded from six to 17 species identifications each, with many more sequences that either did not match anything in our libraries or were ambiguous. Mostly, the sequences lined up well with the vial contents I had recorded before submitting them to the lab. There was one unexpected identification of a fourteen-spotted lady beetle, a conspicuous, colorful beetle that I had not seen in the samples. It may have been present as a tiny fragment of beetle tissue, as lady beetle excrement, or as a meal in the gut of one of the other insects in the sample.

As NGS methods improve and as our library of identified sequences grows, the stage is set for asking and answering many questions about wildlife. Researchers have described microbial diversity from samples of soil, examined plankton assemblages from seawater, documented the diets of insectivorous bats from their guano, and even put together a list of plants eaten by extinct cave bears from plant DNA in their preserved scats.

Here on the Refuge, we can now quickly investigate the diets of insectivorous birds, mammals and fish from their droppings at a relatively low cost. An anticipated application is for routine monitoring of insect communities over time, where it is highly desirable to eliminate the time-consuming handling and identification of individual specimens the old fashioned way with a microscope.

Matt Bowser serves as Entomologist at the Kenai National Wildlife Refuge. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Following the Alaska Dream

by Candace Ward



Hikers in pursuit of the Alaska Dream looking over Doroshin Bay and the Skilak Glacier outwash plain in Kenai National Wildlife Refuge (credit: KENWR).

When I was 6 years old, my family traveled the Alcan Highway from California to the Arctic Circle in Alaska. We visited relatives who lived on a subsistence farm in the Peace River country of northern British Columbia and stayed with friends in a log cabin north of Fairbanks.

The adventures from that trip kindled a life-long love of northern latitudes that led to my time as a high school exchange student in Norway and eventually to seasonal jobs in Alaska from Lake Clark to Denali. Ultimately, the lure of following the Alaska Dream led my husband Walter and me back to the Kenai Peninsula over 30 years ago.

While I have always loved getting out and experiencing Alaska adventure first hand from the canoe system of Kenai National Wildlife Refuge to the brown bear country of Katmai, I also find great inspiration in the reading the stories of other people who were

motivated to follow their “Alaska Dream.” Some great “reads” that I’d like to recommend on this theme include:

***Winds of Skilak* by Bonnie Rose Ward**—Follow Bonnie and Sam Ward’s adventurous move from the suburbs of Ohio in 1980 to live “off the grid” on a private inholding on Caribou Island located in Skilak Lake (on Kenai National Wildlife Refuge). As Sam and Bonnie adapted to a remote life without modern day conveniences, they discovered the benefits of new friends, more time for each other, and the beautiful scenery of the Kenai Mountains and Skilak Lake. This book won a 2014 Next Generation Indie Book Awards/Memoir and also was an award-winning finalist in the 2014 USA Best Book Awards Autobiography/Memoir category.

***Two against the North* by Ida White Sharples**—Ida White Sharples and her husband left Juneau in the

late 1930's to build a remote homestead on the Kenai Peninsula. To reach their new home site, they traveled by boat from Kenai Lake down the upper Kenai River braving the rapids of the Kenai Canyon and then crossed over to the south side of Skilak Lake where they built their homestead. Ida had a love of wildflowers and worked to set up an Alaska wildflower seed business. She also was the author of the first book on Alaskan wildflowers—*Alaska Wildflowers* (Stanford University Press, c. 1938). Look for this Kenai Peninsula homesteading story in local libraries as the book is now out of print.

First Wilderness by Sam Keith—Sam Keith is best known for writing the 1973 best seller *One Man's Wilderness* about the remote life of Dick Proenneke in the Twin Lakes country of Lake Clark National Park. Sam Keith and Dick Proenneke were lifelong friends that both passed away in 2003. Ten years later, an unpublished manuscript written in 1974 by Sam Keith was discovered by son-in-law, author/illustrator Brian Lies. This work is now a new book, *First Wilderness*. The book tells the story of Sam Keith's own Alaska adventure experiences—some with his friend, Dick Proenneke, and others even on our Refuge on Tustumena Lake. This book will give Dick Proenneke fans something new while adding to adventure stories

about the Kenai Peninsula.

Arctic Son—Fulfilling the Dream (DVD and new 2014 edition book)—Authors and filmmakers **Jean Aspen** and **Tom Irons** (now living in Homer) share their story of moving to Alaska's remote Brooks Range in the spring of 1992 with their 6-year-old son, Luke, and friend Laurie Schacht. Living alone for more than a year, they had the energy and insight to keep journals and to film building a cabin and their day to day life in this remote wilderness. They were inspired to create both a book and a DVD. The DVD shows on PBS stations throughout the country (including Alaska's PBS Station—360 North).

Jean has also written **Arctic Daughter: A Wilderness Journey** which recounts her youth in the wilds of the Brooks Range. Long out of print, a new edition is scheduled for release in April 2015.

To find these books, check out our local libraries and community book stores. Wishing you inspiration as you follow your Alaska dreams!

Candace Ward is a park ranger, who has worked in the Refuge's Visitor Services Program for over 30 years. Find more information about the Refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

The lively winter life of quaking aspen

by Elizabeth Bella



Quaking aspen continue to photosynthesize in their greenish-tinged bark even after their leaves have dropped in winter, a season when other deciduous trees are completely dormant (credit: E. Bella/KENWR).

From the warmth of my office, the view includes a magnificent stand of quaking aspens along the ridge near Headquarters Lake. During particularly frosty days as we've recently experienced, I always wonder how these seemingly delicate and graceful trees manage to survive the long darkness and the deep cold typical for this time of year.

Quaking aspen is known variously by many names, including trembling aspen, golden aspen, mountain aspen, popple, poplar, and trembling poplar. Here on the Kenai Peninsula, stunning quaking as-

pen stands can be seen along the highway on the way through Cooper Landing, with close encounters on many trails such as the Kenai River Trail or the Skyline Trail on the Kenai National Wildlife Refuge. Many neighborhoods are nestled in small stands of quaking aspen too.

Roughly one third of the land area is forested on the peninsula, and of that, over sixty percent is coniferous forest. Pure aspen stands make up only a small percentage of the deciduous forests, but mixed forests of spruce and hardwoods comprise close to thirty per-

cent of our forests. Though the percentage is small here, quaking aspen is the most widely distributed tree in North America, and the second most widely distributed in the world.

Quaking aspen is well-adapted to the cold through some typical tree strategies, and one very special one. For plants, the secret to survival in high latitudes is to stay small. Trees are no exception, generally growing smaller further north, limited by cold tolerance or moisture availability. In higher elevations the same principle applies, with shorter, stunted versions of trees that are full grown several hundred feet down the mountain.

Quaking aspen maximum height is only around 80 feet in Alaska, with more common heights around 50 feet. Some trees can live to be close to 200 years old, but generally the upper age limit is around 80 years.

Aspen commonly grows in multi-stemmed clones. Aspen can reproduce by root sprouts, or suckers, after only one year of age, a handy adaptation in marginal climates. The propensity for root sprouting can form large clones whose leaves all change color at the same time in the fall, or leaf out at the exact same time in the spring. Some aspen stands are thought to be thousands of years old, originating from one tree.

In addition to vegetative reproduction, the aspen covers all its reproductive bases by producing seed crops every four or five years, pollenated by wind. The seeds have long silky hairs to cover vast distances, which helps reestablish stands after disturbances. Aspen is often the first tree to reappear and aggressively colonize after a disturbance such as a landslide or a wildfire.

Severe fire can kill aspen, but stands of this tree serve as an excellent fire break because little fuel accumulates in them. Overwinter freezing can cause frost cracks, and hail can damage young stands of trees in particular. Drought is thought to be hard on this species. At higher elevations, such as along the Skyline Trail, the growth form can be stunted.

Hares and beavers like to eat the young sprouts, and moose can damage trees by “barking” them with their incisors. Moose also rub their antlers on the bark, causing damage. These injuries can invite secondary attacks by insects or diseases, such as shoot blight, a

variety of stem cankers, or leaf rust fungi. Minor damage can be caused by grouse, which feed on the buds in the spring, and leaves in the summer.

With so many fragilities, why is quaking aspen so persistent and widespread? The tree’s ability to thrive in what is otherwise mainly a conifer-dominated high-elevation, high-latitude realm is the unique characteristic of its bark. The living bark layer contains chlorophyll and can carry out photosynthesis, a task usually reserved for tree leaves.

In winter, when other deciduous trees are mostly dormant, quaking aspens keep producing sugar for energy. Trees found growing in higher elevations or more northern latitudes tend to have greener bark with higher chlorophyll levels as an adaptation to cold winter temperatures. Older trees develop grayish, furrowed bark.

Why does the aspen quake? The leaf stalk is flattened, and set perpendicular to the surface of the leaf, which makes the foliage susceptible to the slightest movement of air. This adaptation allows the leaf to twist easily, offering resistance to wind damage. This structure may also improve the photosynthetic rate, by allowing more light through to inner leaves throughout the day.

The aspen is well-represented in literature and stories stretching back centuries. In the 1600s, a poem likened the constant fluttering of leaves to the tongues of malicious gossipers, “prest to wave with every wind.” In folklore, the quaking aspen was a haughty tree. When the Great Spirit came to visit the forest, all the forest creatures trembled and shook with fear and reverence except the aspen. The Great Spirit was offended, and declared that henceforth whenever anyone looked at it, the aspen would quake and tremble in deference.

No matter what time of year, the quaking aspen provides a striking contrast to our darker conifer forests. On your next journey through the winter woods, take time to contemplate the hidden hardness of this remarkable tree.

Elizabeth Bella is the vegetation ecologist at the Kenai National Wildlife Refuge. Visit <http://www.fws.gov/refuge/kenai/> for more information about the Refuge.

115th Christmas Bird Count: Records fall

by Toby Burke

A consistently warmer than normal November and December, with scattered days and even nights above freezing, resulted in a mid-winter landscape exhibiting a dearth of snow and local rivers and streams open their entire courses. Average temperatures were well above normal for the period. The mild weather pattern defined the 115th Audubon Christmas Bird Count (CBC) in our local Soldotna count circle. The count was held December 20th

With virtually no sea ice in Cook Inlet, area bird counters found two species of ducks not previously recorded on the count—Greater Scaup and Surf Scoter. These two open water species are normally excluded from our ice-choked marine waters. Both species winter in Kachemak Bay in large numbers with scattered flocks occasionally occurring as far north as Ninilchik, to the extent where marine waters usually remain ice-free. While two Surf Scoters were found, sixty Greater Scaup were observed in a single flock—a surprisingly large number for a first CBC record!

Open marine waters have become more common during our last several counts, resulting in recent CBC “firsts” of White-winged Scoter, Common Loon, and Common Murre—species usually restricted to the lower Cook Inlet in winter. Additionally, in November, a Steller’s Eider and a Horned Grebe were both observed in the ice-free lower reaches of the Kenai River. These species were previously unknown so late in the year. As our winter climate warms, the occurrence of new winter species is happening almost annually.

Three other duck species were found in record numbers this year: Mallard (482), Long-tailed Duck (87), and Common Goldeneye (411). Mallards and Common Goldeneyes are species found in both fresh and marine winter waters while Long-tailed Ducks are strictly marine in winter. Nearly every duck species recorded on the count far exceeded or approached previous all-time highs. More open water, not surprisingly, is attracting more wintering waterfowl to our area.

Among land birds, Rock Pigeons, Red-breasted Nuthatches, Brown Creepers, and White-winged Crossbills also were recorded in record numbers. The increase in Rock Pigeons (56) can be attributed to an

increase in suitable urban habitat with its associated artificial food sources. But, accordingly, this species’ existence is tenuous at best as they depend nearly solely on hand-outs and are quickly predated upon outside their urban haunts. Red-breasted Nuthatches (47) and Brown Creepers (6) are temperate species that gained a toehold in our area nearly fifty years ago and continue to slowly but steadily increase and grow more widespread in our receding sub-arctic climate.

White-winged Crossbills took the title as the count’s most numerous bird species. This irruptive finch species is directly benefiting from the area’s banner crop of spruce cones (see Matt Bowser’s August 15th Refuge Notebook article). This winter you cannot escape these ubiquitous and noisy flocks as they are everywhere in our conifer-dominated forest habitats. Large numbers should remain and breed in these habitats. As an irruptive species they are characterized by magnificent boom and bust cycles—plentiful one year and nearly absent another. Unlike snowshoe hares, when preferred local foods become scarce, they don’t die-off but instead migrate great distances in search of huge cone crops among the continent’s vast coniferous forests.

But as notable as the record highs counts are, so too are species that were detected in significantly lower numbers. Bald Eagles (259) and Common Raven (272) numbers were down markedly. The vast majority of both species are found in the Soldotna landfill each year. This year, however, with so much open water, especially along the Kenai and Kasilof Rivers and Skilak and Tustumena Lakes, both species widely dispersed along these and other water bodies, foraging more on native foods and less on human waste. So these “declines” don’t indicate so much a change in population as a temporary change in distribution.

Not only do CBC counters note what we see but also what we don’t see. Barrow’s Goldeneyes, never abundant or widespread in our specific count area, but a fairly consistent winter resident of the recent past, are becoming increasingly difficult to find. Over the last seven counts we’ve been unable to document them within our count circle. Understandably, some years they are nearly absent, as in very cold years when

there is little open fresh water along the Kenai River. But, lately, counters are unable to find them even when there is sufficient open water and even when their closest relative, the Common Goldeneye, is found in abundance. Questions abound.

As our sub-arctic climate grows temperate and our wild habitats become urbanized, our local bird populations respond to those changes—sometimes rapidly and conspicuously, and sometimes slowly and imper-

ceptibly. Local Christmas Bird Count citizen-scientists revel in uncovering these gross and fine trends, cycles, and patterns, both locally and continentally.

Toby Burke is a biological technician at the Kenai National Wildlife Refuge who is intrigued by the status and distribution of Alaska and Kenai Peninsula birds. Find more information about the Refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Finding the meaning of the moose

by Matt Conner



The bronze statue of a bull moose at the Kenai National Wildlife Refuge's new Visitor Center needs a name.

I have a confession. I am terrible with remembering people's names. I can remember the Latin names of trees, insect, animals, and even recite lines from movies that I watched years ago, but I have trouble recalling if the guy that lives down the street is named Kevin or Steve. Perhaps it is because Latin names are consistent. Every black spruce looks (for the most part) like another black spruce. But Scotts, Leahs, Michelles, Garys, and Candaces all look different.

Knowing the common and scientific names of plants and animals is an important part of my job. When I share nature with the public, the most common question I get is, "what is the name of this?" There is power in naming and knowing how to identify things in nature. Once we learn to distinguish species from others, we begin to see that plant or animal, noticing it more often than before. The first time someone showed me what elderberry looked like, I later realized it was in the woods behind my house but I had never noticed it before.

So, my Kenai friends, I need your help with a name. We will be unveiling a new bronze statue at our visitor center opening in May. The life-sized Kenai bull moose sculpture is sure to be a favorite photo opportunity for all visitors and residents to the Kenai area. As this will become a beacon for our visitors and community, we are asking for your help in giving this

statue a name. This is an important moment for the Kenai Peninsula and finding a name that captures just the right sentiment is complicated. Not a name like "Mike the Moose" but something more meaningful like "Spirit of the Refuge" or "Sentinel of Kenai."

Picking the right name can be challenging so let me give you a little history to better prepare you for this assignment. The Kenai National Wildlife Refuge was originally named the Kenai National Moose Range in 1941. But, in 1980, the Alaska National Interest Lands Conservation Act (ANILCA) changed the name and purposes of the refuge to include the conservation of all wildlife (and fish!) populations and habitats in their natural diversity. This expanded purpose is well represented in the new exhibit hall. Just as moose served as early inspiration for land protection here on the Kenai, this statue will inspire future visitors as they begin their exploration of the Kenai National Wildlife Refuge. It represents and signifies the Refuge's history, original purpose and early name before Congress passed ANILCA.

If you are someone who is good with names, email me your suggestions at matt_conner@fws.gov by March 13th. A judging committee will select the winning name from a list of all of the name suggestions. At the grand opening the winner will be announced and awarded a miniature faux bronze statue of the moose as their prize.

Also at the opening in May, Refuge rangers will discuss the design and concept of the new facility and share the story of the creation of the new center. The theme behind the new exhibit hall is "Icefield to Ocean," a nod to the Refuge's broad mix of habitat types. Icefield, tundra, boreal forest, wetlands and rivers are all represented. It's why the Kenai Peninsula is often called "Alaska in Miniature."

There is a newly restored cabin behind the visitor center and the cabin crew will visit with the public about the restoration process and historical significance of the cabin. The Refuge has restored several historic cabins and maintains 16 cabins available for the public to use. The latest restoration behind the visitor center is the Elwell cabin, which was originally located at Upper Russian Lake and was relocated to the

new visitor center as a means to share with the public the significance of the Refuge's cabin program.

Who will find the words that capture the meaning of the moose? The winning name could come from anyone! Perhaps it will be a child, angler, hiker, hunter, nature photographer or maybe even my neigh-

bor Kevin...or was his name Steve?

Matt Conner is the Visitor Services Manager at Kenai National Wildlife Refuge. You can find more information about the Kenai Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Permitting Kenai National Wildlife Refuge commercial guides and outfitters

by Donna Handley



An angler enjoys a day of fishing on the banks of the upper Kenai River within the Kenai National Wildlife Refuge.

It's a slow Tuesday morning in February, when suddenly the phone rings for the first time all day. It's Betty Lou from Arlington, Texas, and she is planning her very first trip to Alaska! Betty Lou is thrilled and is wondering what the Kenai National Wildlife Refuge has to offer her.

Usually, at this point, I have to remind myself not to overwhelm her with all the great things there are to do on the Refuge. So, I probe a bit to find where her true interests lie. After a 30 minute conversation about all the different recreation opportunities, it is crystal clear that Betty Lou's main goal is to fish for salmon on the Kenai River.

However, Betty Lou is a classy lady and doesn't want any of that elbow-to-elbow stuff. She wants a well-qualified fishing guide to show her the sights from the comfort of a boat. Luckily for the Refuge

and Betty Lou, there are many well qualified, permitted guides and outfitters to ensure that she will leave a happy visitor with fond memories and a smile on her face.

The Refuge provides commercial guiding/outfitting permits for many reasons. At the most basic level, without guides some of our visitors would be unable to experience the Refuge in the ways they wish. After all, not everyone can back up a boat trailer, safely operate a boat, rig up a fishing rod, interpret fishing regulations, and identify the bird flying overhead or the mountain range on the horizon.

Also, it is within our Refuge purposes to ensure visitors have great recreational opportunities and, if service is needed, then we want to ensure that it is offered by qualified permit holders in a safe and conservation-minded way.

Meanwhile, Betty Lou also has other interests like a multiple-day wilderness canoe trip or maybe even an air taxi ride out to one of our remote public use cabins for the night. My job is to share information on the commercial guided and outfitting services available in the area. With a clear conscience, I know that she is in good hands no matter which individual or company she chooses because they have met the requirements set by state and federal regulations.

Let's take the a commercial sportfishing permit as an example since the majority of the Refuge commercial visitor service providers are for water-based activities such as sportfishing or scenic floats on the Kenai River. Portions of the Kenai River within the Refuge include river miles 25.1 to 28, river mile 45.4 upstream to Skilak Lake, Skilak Lake itself, and Skilak Lake upstream to Russian River (Upper Kenai River). The Upper River is an area with a limited number of permits that are awarded through a "prospectus process." The prospectus process is a lengthy application process (that is not available every year) that includes review and ranking by a panel of at least five people.

All other areas of the Kenai River are non-competitive based but still require a permit. After an application for a non-competitive Special Use Permit is submitted and reviewed, it is probationary for the first year once approved. A successful year allows for a five-year renewal, but annual updates must occur each year before the start of operation for the season (no later than June 1). The application process starts over at expiration in 5-year intervals.

By sending out new releases and posting them under the "news" section of our website, we try to give as much time and information for outfitters and guides to be successful in completing the application process by posted deadlines. Failure to return client use reports in a timely manner (by November 15th) or committing permit violations can jeopardize future permit opportunities and limit visitor experience. Other required licenses and permits are also issued by Alaska State Parks, Alaska Department of Fish & Game, and the U.S. Coast Guard, all of which also have their own agency requirements.

It is great to build this symbiotic relationship with commercial service providers here on the Peninsula. The Refuge just recently announced the application open period for the described non-competitive commercial visitor service permits. Follow the link to see our news release on the subject here: <http://www.fws.gov/uploadedFiles/15-001.pdf>.

I look forward to working with all who have permitting needs here at the Refuge Headquarters office, helping to update and issue the annual permit decals, and meeting new applicants for a commercial special use permit. If you are interested in obtaining a permit remember the deadlines are creeping up like the sunshine every day, and visitors like Betty Lou are calling!

Donna Handley is an administrative assistant at the Kenai National Wildlife Refuge. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

“Hey moose, nice baby!”: prep now for springtime walks

by Leah Eskelin



A mother moose and her newborn graze on spring foliage at the Kenai National Wildlife Refuge. (Photo credit: Berkley Bedell/USFWS)

“Hurumph!” This is a sound you never want to hear from the woods when you are walking along a trail. This guttural bellow followed by crashing of underbrush is not what you want to hear when you are alone on a trail and have been watching your footing on the ice instead of being alert to your surroundings. Those two sounds getting closer to you in the brief few seconds between a calm pulse and the rush of adrenaline that makes your eyes go wide and your palms sweat is the last thing you want to notice when you are alone, on an icy trail, carrying nothing but a pen and notebook on the way to a meeting...but they were my reality late last week.

When do you start thinking about wildlife safety? I took note this month as reports of bears awake on the Kenai Peninsula started coming into the office here at Kenai National Wildlife Refuge. I listened up again when new signage on this subject was reviewed for an audio narration project at the new Visitor Center. But on a calm, warm Thursday afternoon within sight

of my car and walking between two buildings I spend most of the work week inside, I had let my guard down. I had walked right by a moose and her baby grazing along the forest edge. I am glad I have trained to respond in this dangerous situation with appropriate action.

As soon as I saw baby flushing towards me in a panic, with mom some yards behind, I found firmer footing in the snowbank and lifted my arms. “Hey moose!” I called out, stepping backwards into the alders as far as the ice and brush would allow. “Hi there, it’s just me. I didn’t see you. What a good mom you are. Hey there, moose.” It’s comical thinking back to my one-sided conversation. It seemed to work, though, identifying myself as human, setting the tone as calm but firm, and I didn’t stop talking and holding my hands high over my head until both moose had turned, retreating, with calmer gaits. Mother moose stopped to urinate. At the time I thought that was odd.

Later, recounting the event with Refuge biologists,

I found out that it is a sign of fear. I also discovered that the negative reaction of mother moose to my non-threatening slow walk down a regularly traveled driveway could have signaled another threat in the area which had set her on guard. Could it have been a bear she had smelled that day? Did another person just chase her off from another part of the trail system? Did I just startle her by walking too near her baby when I wasn't paying attention? I will never know what impelled her to bluff charge instead of lazily watch me from the woods as she has all winter (she and her yearling calf are regulars on Ski Hill Road) but I am grateful the reading and thought I had put in earlier was there when I needed it.

It wasn't more than a minute before both mother and baby were heading away into the forest and over a hill, with just a backwards glance from baby ending our encounter. I kept an eye on these moose, now off in the distance, as I recovered my discarded notepad from the snow berm, thankful we had parted ways after just some warning words and my retreat. I was also glad only she had peed her pants!

Mothers of any species are protective. A mother moose caught off guard with a baby straying too close to a surprising human? She is on high alert. I learned how quickly she can go on the defensive during our brief encounter on that icy trail. Later this spring, mother moose will be welcoming their newborns to the world. Shaky on their spindly legs, these babies keep close to their moms, who are ever watchful for danger, perceived or real. It's a season we humans also venture outdoors after long icy winters and this can mean the potential to meet these pairs on area roads

and trails.

Please take a moment this spring to review safe wildlife practices, discuss and practice them with your family, and set up a safe walking plan with your kids so they are prepared if they encounter a moose or bear outside. The Kenai Refuge Reflections Visitor Guide offers some quick safety guidelines for bears and moose on page 5, (available at <http://1.usa.gov/1Gow2ca>). Here are the basics when you encounter a moose:

- Move away! Maintain at least 75 feet between you and a moose.
- Watch for body language—if the moose lowers its head and ears, and the hair on its back and neck stands up, back off.
- If a moose charges, retreat behind a large tree or rock—most charges are bluffs and getting behind something solid offers important protection from their sharp, powerful hooves.
- Remember, keeping your distance from moose is the best way to avoid a negative encounter.

Find more helpful wildlife safety tips at the Alaska Public Lands Information Center website on both moose (<http://www.alaskacenters.gov/traveling-in-moose-country.cfm>) and bears (<http://www.alaskacenters.gov/bear-safety.cfm>).

Leah Eskelin is a Visitor Services Park Ranger at the Kenai National Wildlife Refuge. Find out more about the Refuge events by visiting <http://www.fws.gov/refuge/kenai/> or by liking us on Facebook.

Ode to crows, ravens, jays and magpies

by John Morton



Silhouette of the Steller's Jay, one of five corvid species found on the Kenai Peninsula. Georg Steller, its namesake, was the naturalist who accompanied Commodore Vitus Bering on his exploration of Alaska in 1741-42.

I recently co-authored an article in Bird Conservation International on the demographics of Mariana Crows. While always pleased to have a paper published in a scientific journal, I was absolutely dismayed that in the 15 years since I last studied Mariana Crows, it became officially extirpated from Guam because of the brown tree snake, and declined from 225 known breeding pairs to only 60 on Rota, a tiny island and the last place on earth these birds exist in the wild. The Mariana Crow is now red-listed as one of the world's critically endangered species by the [International Union for Conservation of Nature](#) (IUCN).

For any number of reasons, I find this disheartening. First, the Mariana Crow is one of almost 17,000 species that the IUCN forecasts are likely to go extinct. Second, I know how much effort was spent over two decades to help Mariana Crows survive on Guam, constructing electric barriers around nest trees (to keep

snakes away) at night, releasing crow chicks raised from eggs produced by both wild and captive parents, and shooting and trapping predators.

But the biggest reason is that I really respect Mariana Crows as only someone can who has chased them for years in tropical jungles of the Western Pacific, tracking the breeding success (or not) of pairs year-round. On both Guam and Rota, I staffed field stations with up to 8 biologists who, wearing varying amounts of camouflage, gave chase to these very smart birds.

One of the rites of passage for new biologists to the islands was to discover that once a crow knew where you were, their overt behavior was always suspect, designed to lead you AWAY from the nest, not towards it. A trick sometimes used when we were close to an active nest that couldn't be found was to have two people approach the area, allow the male crow to "lead" one of the transgressors away from the nest, while the

other person lay in waiting until either the female on the nest or the returning male called to the other very quietly (more a grunt than a caw), thereby giving away the location of the nest in a very dense forest canopy.

Members of the crow family (Corvidae or corvids) are indeed some of the smartest birds due to their longevity and high brain-to-body mass ratio that is equal to great apes, whales and dolphins, and almost that of humans. The New Caledonian Crow, for example, not only uses sticks as tools to capture grubs, it has been seen making hooks by bending wire! Other corvids, such as many crows, magpies and jays, are excellent mimics. Some species of scrub jays engage in “helping at the nest,” in which young from one brood will help raise a subsequent brood by the same parents. Crows can count to at least seven, and many corvids have a highly-developed ability to re-locate cached food items.

We are lucky here on the Kenai Peninsula. By virtue of being at the intersection of the western-most reach of the boreal forest and the northern-most reach of the coastal rainforest, we have five corvid species. The Common Raven, Northwestern Crow, Gray Jay, Steller’s Jay and Black-billed Magpie reside year-round. Although I never did quite figure out how many places in North America have five or more corvids living together, I can tell you that it’s uncommon.

Christmas Bird Count data ([available online](#)) suggests that statewide winter populations of these five species have either remained the same or increased over the past 3 or 4 decades despite wide fluctuations. Anecdotally, we’ve seen increases in Steller’s Jay, Northwestern Crow and magpie on the western side of the Kenai Peninsula in recent times, which may reflect an urbanizing landscape as most corvids coex-

ist well with humans. An interesting book entitled “In the Company of Crows and Ravens” postulates that corvids and humans have culturally co-evolved over the millennia.

If you’re interested in corvids, there are many other good contemporary books, mythologies from many cultures, and many excellent poems—“The Raven” by Edgar Allen Poe to name one. The collected writings of Peter Kalifornsky has several Kenaitze stories about “Ggugguyni” (raven) and “Gizha” (the camp robber or gray jay).

While corvids on the Kenai are a very long ways away from being in the same dire straits as Mariana Crows, disease looms as a concern. When West Nile Virus first appeared in North America in 1999, this mosquito-borne virus caused very high rates of mortality in corvids, killing 5,500 crows during the first four months of its introduction. Although it has spread westward, this virus is still not in Alaska and recent research indicates it has mutated to be less lethal to corvids.

More locally, beak abnormalities (such as crossed bills) in chickadees and corvids have been studied for several years in the Cook Inlet basin by Colleen Handel at the USGS Alaska Science Center. While nothing is conclusive yet, most evidence suggests that environmental contaminants such as organochlorines may be culpable.

So sit back and really pay attention the next time a corvid shows up at your feeder. They’re fascinating to watch and we’re unusually blessed with five species.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Living with climate change in our backyards

by Elizabeth Bella



Does climate change affect bluff erosion on the Kenai Peninsula? Find out this Saturday at a free workshop on climate change and what to do about it at the [Kenai Peninsula College](#).

Here on the Kenai Peninsula we can all agree that this winter has been strange. The effects of a changing climate are becoming obvious in many ways, including the discouraging plus-forty-degree rain and lack of snow cover. We can celebrate lower heating costs, but many of us have missed our usual winter activities.

We likely all agree that this is a pretty special place

to live, and there are countless reasons why all of us have chosen to make this land our home. One question we can all ask ourselves is “what do we love about the Kenai Peninsula?” My friends and colleagues share many common themes in response—love of the ocean, forests, wildlife, camping, fishing and hunting. We love our close-knit communities, our access to wild and beautiful places, and our stunning scenery. In the simplest sense, we love our way of life here.

With a changing climate, the future is uncertain. Beyond just this weird winter, we’ve all experienced other aspects of change. Last summer’s massive Funny River Fire is still fresh in everyone’s memory, and we’re all nervous about the lack of snowpack and moisture this coming spring with the threat of grassland fires in April. Higher temperatures in nonglacial streams are already falling into the lethal range for salmon during short periods in July. The increased growing season for vegetables and fruits also means a better environment for many non-native plants and animals. Although apparent sea level rise in our surrounding marine waters is not yet a concern, bigger storms are generating larger waves and increasing coastal erosion, and flooding events seem more frequent.

Other changes may be subtler, such as pollinators becoming out of sync with the plants and flowers they have evolved to pollinate—which could result in widespread changes or diebacks of native flora, also affecting wildlife food sources.

We do know that our actions today can guide and direct the kind of future we want for our grandchildren’s grandchildren, so starting the conversation now will help our communities plan for climate change. Please join the Kenai Refuge in supporting the Central Peninsula League of Women Voters and the Kenai Peninsula College Student Union at the upcoming Climate Change in Our Backyard workshop, taking place this Saturday, March 28th, at [Kenai Peninsula Community College](#). The workshop starts at 9AM and continues to 4PM—and is entirely free, with lunch and snacks provided. Attend for the whole day, or stop in for some of the speakers and discussions as your schedule allows.

The workshop culminates in a mayor's panel discussion, preceded by several researchers who will speak to what we know about local effects on Kenai's climate, plants and wildlife, wildfire, coastal erosion, and salmon. The featured keynote speaker at lunchtime is author Nancy Lord of Homer.

The mayor's panel discussion is a chance for all community members to weigh in with their ideas and concerns about climate change. The mayor or their representative from the Kenai Peninsula Borough and the cities of Homer, Seward, Kenai and Soldotna will help us think through ways that we can begin developing adaptive strategies and solutions to cope with real and anticipated climate changes. The good news is that change brings opportunities.

More information about the workshop, including the agenda and a variety of resources, news, and videos about climate change is available on the workshop website, <http://kenaichange.org>. You can also like the Facebook page, <https://www.facebook.com/kenaichange>. There's a Facebook Event set up, so you can join and invite others: <https://www.facebook.com/events/837357299669445/>.

While the workshop isn't able to live stream the event by internet this year, we will be recording the talks and discussion for later viewing and discus-

sion. The organizers strongly encourage all communities, big and small, from around the Peninsula to participate—so take advantage of ride sharing opportunities to come to Soldotna this Saturday. There's a link to a [Kenai Peninsula Facebook ridesharing page](#) on the workshop webpage, or get in touch with friends and neighbors that may be interested in catching all or part of the workshop on Saturday.

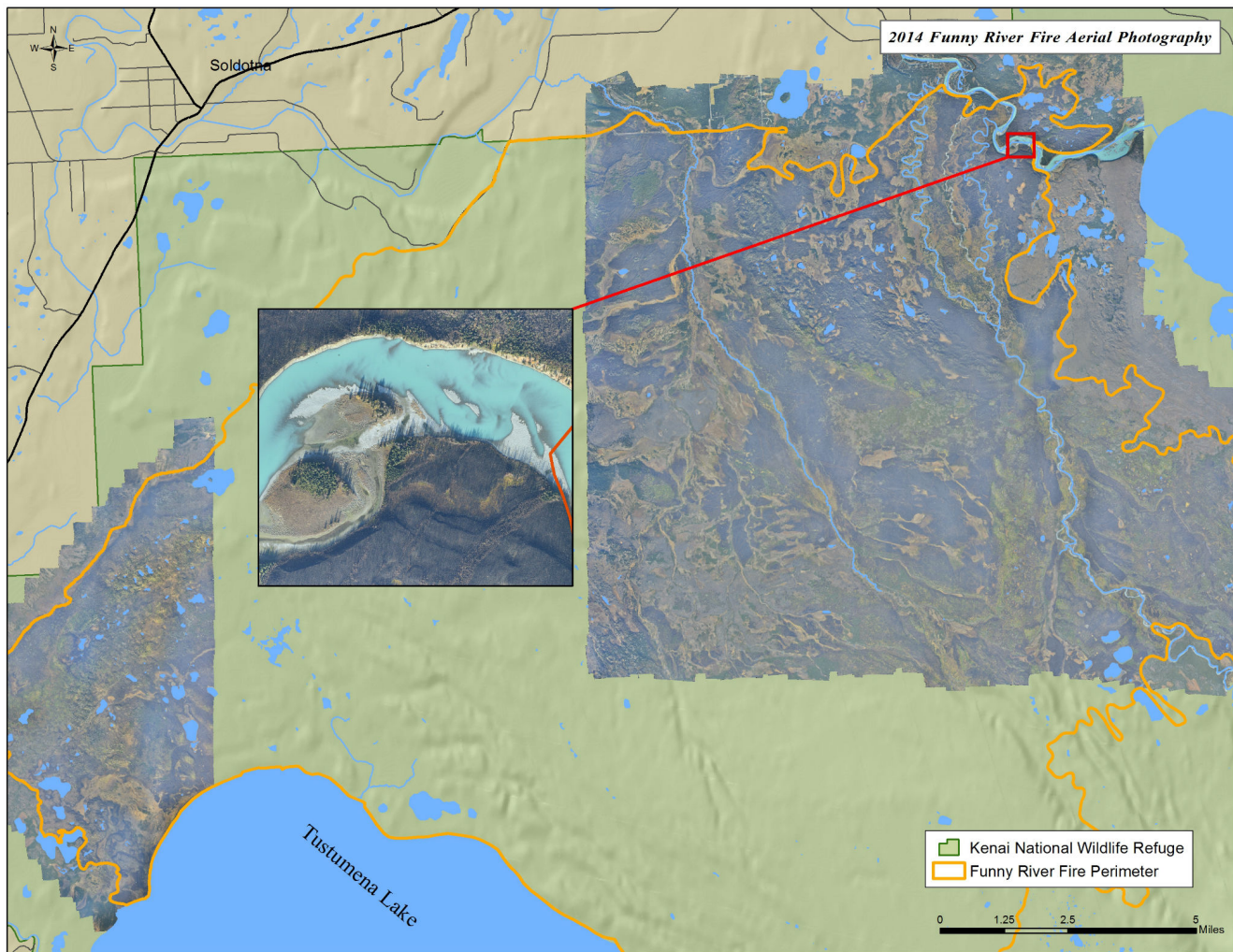
The workshop will also feature a children's program for all interested families with kids ages 3 to 10. Please pre-register on the website's contact page. Kids will enjoy a variety of educational activities and give a presentation to the main workshop during the lunch break.

Since it's unlikely any of us will be out skiing or snowmachining this Saturday, be sure to stop by and join the conservation, meet your neighbors, hear some interesting talks, and enjoy free refreshments and a local-ingredient lunch. As a community we have the opportunity to start planning now for anticipated changes to ensure that our spectacular, unique, and beloved landscape is still intact for future generations.

Elizabeth Bella is an ecologist at the Kenai National Wildlife Refuge. Visit <http://www.fws.gov/refuge/kenai/> for more information about the Refuge.

New aerial photography technology: little camera—big picture

by Mark Laker



Mosaic of high-resolution aerial photographs of 110,000 acres of the Funny River Fire was captured in less than eight hours of flying. The inset shows the clarity of one segment of the Kenai River.

There are myriads of ways to measure and describe an area, but as they say, “a picture is worth a thousand words.” At work I frequently use Google Earth to look at remote locations of interest. As you zoom in, the clarity or resolution is impressive considering the image was taken from a satellite about 300 miles above the earth.

Actually calling it an image is incorrect. With each

sensor the satellite observes a small area called a pixel, one at a time. The sensors sweeps back and forth recording row after row of pixels, which are later compiled to create an “image.”

This technology is different than a digital camera which contains an array of millions of photosensors (one for each pixel) to capture the whole picture in just one click. The ability to repeatedly image large areas

of our planet in great detail makes satellites a remarkable tool. Unfortunately, that technology comes at a cost, one that is prohibitive for small projects.

Last year, after the Funny River Fire was officially out, we were able to start assessing the effects the 200,000-acre fire had on the landscape. Fire is a powerful natural disturbance that can bring about great destruction but also great ecological benefits. This fire created a striking visual mosaic as it burned through the patchwork of ecosystems. Flying over the burned area a few months later revealed the landscape as a medley of blackened forests, islands and fingers of vibrant green, blue water, and some amazing hillsides of fireweed in full bloom. It was quite beautiful, and I was itching to photograph it. Not just a handful of critical areas, but the whole thing!

A few years ago, Nikon came out with a 36.6 megapixel camera. In the steady progression of camera resolution, this might not seem revolutionary, but the size was just large enough to change the whole Do-It-Yourself aerial photography game. With the larger format it was possible to take a photo from a safe altitude, with good resolution, and get a 3,000-foot field of view.

Compiling adjacent images into an even larger image is called a mosaic. To create a seamless mosaic, the pictures need to overlap about 60 percent. With the new camera we would need to fly flight lines about 1,500 feet apart. With my older 12.2 megapixel camera, my flight lines needed to be 500 feet apart. That proved difficult to fly consistently, time consuming, so the new camera changed everything.

Capturing the photos is just one part of the process. I calculated it would take about 10,000 photos with my little camera to do the whole job. The final image also needs to be geometrically corrected so you can view it in something like Google Earth. This ensures everything has the correct position and is not distorted. The final image is called an orthophoto.

With new cameras available, some of my colleagues along with Dr. Matt Nolan from the University of Alaska Fairbanks started using a process called Structure from Motion (SfM) to mosaic large areas

with great results. The process actually builds a three-dimensional structure from two-dimensional pictures. The three dimensional model allows for better orthophotos and the creation of high resolution contour and surface maps. For many applications, the three dimensional structure is more valuable than the orthophoto, but now we can have both.

It was October by the time we had our system all together and mostly bug-free. Short day lengths gave us about three good hours a day to photograph. The weather was also starting to turn and the threatening snow would put an end to the project for the year. So we had little time to run complete tests if we wanted to cover some of those 200,000 acres.

With refuge pilot-biologist Nate Olson, our first real test flight was a three hour gamble (that it would work) over 45,000 acres in the northeast corner of the burn. After landing I nervously looked at one of the 1,800 photos we took, and was relieved to see a clear stunning photo. In two more days we were able to capture another 3,300 photos, for a total area of 110,000 acres in less than eight hours of flying.

Processing the photos took my computer about a week to churn through, but it works 24/7 for cheap. The resolution of the final orthophoto was about three times that of a commercial satellite image. You can experiment with creating mosaics and three dimensional models yourself through several websites like <https://photosynth.net>.

The snow finally came, ending the project for the year, but come this May we should quickly capture the remainder of the burn. Fire ecologists and biologists will use the imagery for assessing and monitoring the burn area. With the low acquisition cost, we have plans to use the technology for landcover mapping, habitat change detection, structure and community protection, counting animals, and measuring snow depths.

Mark Laker is an ecologist and database manager at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

What do you value about living on the Kenai Peninsula?

by Dawn Robin Magness



Word clouds are a fun way to show words, where the most important ones are bigger than the others. This cloud shows the responses that participants at a recent workshop on climate change gave when asked what they value about living on the Kenai Peninsula.

The League of Women Voters recently hosted a “Climate Change in our Backyard” workshop. Over 100 people gathered to learn about climate change impacts on the Kenai Peninsula and to discuss solutions. Northern regions, including Alaska, are experiencing faster and more extreme climate changes than elsewhere in the U.S. Alaskans can see disappearing sea ice, melting permafrost, longer fire seasons and eroding coastlines. It is no wonder that a survey conducted by Columbia University in 2006 found that over 81% of Alaskans are convinced that global warming is happening.

Global warming refers to the recent and ongoing

increase in the global average temperature due mostly to increased concentrations of greenhouse gases. The global average temperature is increasing even though regions experience variable conditions year to year. For example, the East Coast has had a colder than average winter this year, while the rest of the globe had the hottest winter since 1998. Climate change refers to any change to temperature, precipitation or wind patterns lasting for several decades. The climate on the Kenai Peninsula is warmer, especially in the winter.

Impacts from climate change are well documented on the peninsula. Since the 1950s, our ice fields are losing mass and dumping more water and silt into our

rivers. Non-glacial streams are getting warmer even as salmon seek colder waters. Alpine tundra and lowland wetlands are being colonized by trees and shrubs. White spruce forests killed by bark beetles are converting to open woodlands and even grasslands as grass-fed fires in spring become the new normal. Some animals and plants are already shifting their distributions and these changes could lead to different hunting opportunities. Longer growing seasons are allowing for new vegetable varieties in gardens.

What can we do as a community? Climate change experts talk about mitigation and adaptation. Mitigation deals with actions or policies designed to reduce greenhouse gas emissions in order to slow or reduce future climate changes. Adaptation involves actions that reduce risks or maximize opportunities emerging from climate change impacts. Mitigation and adaptation are related because without mitigation to reduce current levels of greenhouse gas emissions, adaptation efforts will be more costly and less likely to succeed.

Smart adaptation requires planning for an uncertain future. The military and business communities have come up with methods to strategically plan for future conditions. For example, scenario planning is an approach that helps people to explore options and strategies across a range of alternative conditions. Shell Oil Company was able to recover more quickly than their competitors from the economic consequences of the oil embargo in the 1970s because they had pre-planned for how their company would deal with “shocks” to oil prices. As a general rule, it is best to be “light on our feet” so we can respond quickly to surprises and emerging conditions.

Many communities are developing adaptation plans to help them deal with “shocks” from climate change impacts. Of the adaptation plans I’ve reviewed, what strikes me is that similar themes are addressed as they consider carving out a positive future. Many plans consider how to deal with new or more frequent hazards like flooding, how to build and maintain infrastructure suitable for changing climate conditions, and regional food security (including increasing food production).

Energy security and how to reduce and stabilize energy costs are important considerations for both adaptation and mitigation. Our local representatives are already thinking about this issue as well. In the Mayor’s Panel at the Kenai Change Workshop, borough mayor Mike Navarre, Kenai vice-mayor Brian Gabriel, Soldotna mayor Nels Anderson, Homer mayor Mary Wythe and Seward city council member Rissie Casagrande provided examples of how they are working to become more energy efficient even as alternative energy sources are explored to reduce operation costs.

Even though the themes are similar, what a community ultimately decides is an acceptable or unacceptable future is heavily influenced by the identity and values of community members. For example, the city of Whitehorse identified their unique link to wild lands as a central value in their adaptation plan. What values will residents of the Kenai Peninsula use when they visualize the future? Participants of the Kenai Change workshop were asked this question and their answers were captured in a “word cloud.” Not surprisingly, our salmon fisheries is the central theme that ties us together, although accessible places to hunt, fish, and be in nature also are important to us.

Federal land managers will also need to assess core values as climate change reshapes landscapes. Management of the Kenai National Wildlife Refuge is guided by its legislative purpose “to conserve fish and wildlife populations and habitat in their national diversity, including but not limited to moose, bear, Dall sheep, wolves and other furbearers, salmonoids and other fish, waterfowl and other migratory and non-migratory birds.” U.S. Fish and Wildlife Service policies advise us to use historical condition to assess how well we are conserving fish and wildlife populations and habitat. With climate change, historical conditions may not be possible to maintain.

Dr. Dawn Robin Magness is a landscape ecologist and Fish & Wildlife Biologist at the Kenai National Wildlife Refuge. Like the Refuge at <http://www.facebook.com/kenainationalwildliferefuge>.

Poking at Earth Day with a stick

by Matt Conner



Poking things with a stick is a rite of passage for kids as they learn about Mother Earth (credit: M. Conner).

Earth Day is next Wednesday. It reminds me of a program I taught last year to a 4th grade class in Minnesota before transferring to the Kenai National Wildlife Refuge. We learned about Senator Gaylord Nelson, the founder of Earth Day, and how this event has improved our care for Earth's resources. Starting with a poem about Earth, we looked at pictures from the first 1970 Earth Day and then went outside with journals to think about our own contributions to the planet.

The journal was divided into four quadrants: sketch something new, earth creatures, EARTH DAY acrostic poem, and a writing exercise. The writing exercise was to complete the ellipsis of, "I know I make difference for the Earth because..."

I led the students to a willow tree occupied by hairy woodpeckers, redpolls and juncos, which I hoped would give the students some immediate success with their journals. The birds cooperated but after about ten minutes, the students' attention began to waver. A cursory inspection of their journals showed that most had recorded the birds under Earth Creatures but few had completed a sketch.

The group formed a circle in response to my quiet whistle, a prearranged signal. I asked if anyone had started on the "I make a difference" sentence. Nobody had. I realized that asking a 4th grader how they know

they make a difference for Earth was a bit daunting. After all, what had I done at age 11 to make a difference for the Earth?

I spotted a large burr oak tree and said, "let's go hold that tree up!" With little instruction, I sat down with my back against the tree. The students followed suit. As we looked out in different directions, the student next to me picked up a stick and started poking a rock with it. The student caught me looking at him and put the stick down in a sheepish manner as if caught in the act of being a kid.

I asked the group if they wanted to hear a stick-poking story. The group all agreed, so I told everyone to keep their back against the tree and watch the tree-tops for birds while I quietly told my story.

I described how my own two children were enthralled by the hundreds of migrating robins that had flown around our house last night. Armed with sticks, my kids went outside to hunt robins. Certain no robins would fall prey to the business end of their sticks, I wished them luck and told them to have fun. For the next couple hours, my wife and I would glimpse our son or daughter running by the window, excitedly screaming as they "stalked" the birds.

Later that night at the dinner table I asked for the robin expedition report. Both of my kids started talking excitedly at the same time about the headless bird they found! "Everything on that bird was perfect except its head was gone! We tried to figure out what ate its head and we looked for snakes or whatever animal did that." My wife looked slightly horrified by this report and she asked, "What did you do when you found the dead bird?" Before they could answer I raised my hand and said "wait, let me guess—you poked it with a stick!"

My children gawked at each other and said, "You were watching us?" I explained I wasn't spying, but reminded them I had been a child once too. "Everyone knows that if you find a dead bird, you have to poke it with a stick, it is just the rule of being a kid."

As I finished my story I could see smiles on the 4th graders' faces. I felt guilty for having gotten off topic from the Earth Day message, but I wanted to keep the positive energy we had created. "You might not be the

U.S. Senator that founded Earth Day, but I bet we could do something to teach people about nature in a fun and interesting way. Let's imagine that we are writing a funny children's book about poking things in nature with sticks," I said. "We can use our knowledge about nature but with our humor to get people to read the book and learn about outdoor discoveries."

We decided the book's title would be, "So, I poked it with a stick..." and began coming up with story ideas. One girl said, "I was walking in the woods and found a dead log, so, I poked it with a stick and discovered it was alive inside with insects and worms!" A boy said, "I found some coyote scat, so I poked it with a stick, and saw it had been eating...something with fur." "That's the idea," I said, "what else do we have?" We named fungus, lichens and cattail heads. We also decided that our book should focus on being kind to nature and that no living things would be poked with sticks in our story—only things that were dead, slimy, rotting or decomposing, and normal nonliving nature

things.

Upon returning to the visitor center, I confessed, "I feel a little guilty for not sticking to the schedule today. We never even worked on the 'I know I make a difference for the Earth' statement."

Within seconds one student said, "That's okay, if we could write a book or get people to learn about nature, that IS helping the Earth!" My coauthors and I agreed we needed to explore for more story ideas and think about how to share our discoveries.

As we walked back to the bus, one student asked, "Are we really going to write a book or is this just for fun and make believe?" I replied we might finish our book or perhaps just spend some time by a tree thinking about it. Either way, time outdoors is never wasted. The more time spent outside, the more things we can find to poke with sticks.

Matt Conner is the Visitor Services Manager at Kenai National Wildlife Refuge. Like the refuge at <http://www.facebook.com/kenainationalwildliferefuge>.

Tips for using bear spray

by John Morton



Spraying downward and in front of a charging bear is good technique for using bear deterrent spray. Bear spray only works if you keep it handy so wear the holster on your belt or attached to a pack shoulder strap, but don't stuff it in a pack.

Bear spray is a weapon. Just like any weapon, you've got to know how to use it so it stops what you want it to stop (a bear) and doesn't stop you. What got me thinking about this story is just last week a friend, "Julie", and her niece ended up in our local ER when the bear spray canister stuck between Julie's car seats accidentally deployed. Needless to say, lots of tears and crying.

In contrast to that event, several years ago "Sue", a seasonal biotech at the Kenai National Wildlife Refuge, was walking her aging dog along Schooner Bend on the Kenai River. Sue spotted a brown bear sow with cubs making a fast beeline for her dog. She yelled at the sow, only to have it turn and make a beeline for

her. Sue backed up against a tree and crouched down as she deployed a canister at the charging bear. As the bear skidded to a stop in front of her, Sue could have reached out and swatted its muzzle! A happy ending (although there were probably tears and crying) as the bear turned and ran away.

Bear spray really does work. A 2008 article in the *Journal of Wildlife Management* reviewed 83 bear spray incidents in Alaska during 1985–2006. Threatening behaviors by brown, black and polar bears were stopped more than 90 percent of the time by spray, although in 18 percent of cases, bears had to be sprayed more than once. Only 3 bear-inflicted injuries associated with defensive spraying occurred—all involved brown bears and all were relatively minor, requiring no hospitalization.

But like any weapon or tool, it works better when you know what you're doing. A few years ago, I took a course offered by Counter Assault™, one of several manufacturers of bear deterrent spray. Here are the take-away messages:

Commercial bear spray typically contains 2 percent capsaicinoids (pepper) as the active ingredient, 1.5–2 times "hotter" than law enforcement spray. Unlike sprays used on dogs and humans, which usually come out as a stream to target the eyes, bear spray is inhaled, causing immediate inflammation of the lungs and respiratory distress. It is dispersed as atomized spray, usually orange or reddish brown in color so you can see where it's going. It not only does NOT work as a deterrent if sprayed on a tent, the smell may actually be an attractant!

Most small cans contain about 8 ounces of deterrent and propellant, designed to spray out to 30 feet for 5–8 seconds. But here's the catch. This specification is at ROOM temperature and the propellant pressure is sensitive to temperature changes. Despite rapid climate warming, how often is it 70 degrees on the Kenai Peninsula? So even though you should keep your spray handy and holstered outside your pack, you should also consider keeping it inside your coat when temperatures drop below 50, which it often does on summer mornings or fall days.

Conversely, really warm temperatures can cause

a canister to leak and even explode. I saw one photo where a bear canister left on the dashboard of a closed vehicle had exploded and blown a hole through the windshield. If you regularly leave bear spray in your vehicle, consider keeping it in an ammo box. Kenai Refuge pilots transport canisters in the floats of planes rather than in the cabin to prevent catastrophic deployment. It only seems logical to take similar precautions in your car or truck.

The expiration date on your canister is a guide to go by, not carved in stone. Keep in mind that the effectiveness of the pepper doesn't diminish, but the propellant pressure does. So store your canister in a cool place to minimize expansion and leakage. Dented or otherwise damaged cans should be used as backup spray or for training.

If you have reason to believe a bear is in the area, get your canister out and remove the safety clip. Stick your thumb under the trigger to prevent accidental deployment. Be aware of the wind direction!

Odds are that if you deploy bear spray, it will be on a charging bear. The key is to shoot in front of the bear because you want the fast moving animal to pass through the colored cloud. Spray downward us-

ing short bursts of 1-2 seconds. The typical deployment, according to the aforementioned journal article, is 12 feet from the bear!

In 14 percent of bear spray incidents, the sprayer was negatively affected by the spray. Medical treatment calls for removing contact lenses, flushing exposed areas with cool water and non-oil based soap, drinking milk, calming the person, facing into the wind, NOT applying lotion or creams, and using wet towels or ice packs to reduce inflammation. The good news is that the effects last only 30-45 minutes.

I have extra holsters that I've duct-taped to shoulder straps of various packs I own so a single bear canister can be easily transferred around. Bear spray in a pack doesn't work. Even if I'm carrying a firearm, I or my partner will carry bear spray as a nonlethal alternative. It's a great deterrent for older kids to carry, but keep it away from young kids. Bear spray deploys at about 70 mph and, at less than 5 feet, it can physically damage eyes. Remember, it's a weapon.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Learning to be a game warden

by Kelly Modla



Officers Shay Hurd (Kenai National Wildlife Refuge), Daniel Carnow (NOAA), and Jacque Kosto (Alaska State Parks) help kids learn to shoot with air rifles.

This past weekend, the Kenai National Wildlife Refuge hosted the 2015 Youth Game Warden Camp. This camp is a collaborative effort between natural resource agencies to provide young people an opportunity to meet and learn about the interesting job of a game warden. They discovered that you need to be a little bit curious, take a keen interest in wildlife and fisheries management, natural resource law enforcement, enjoy interacting with the visiting public, be a quick thinker, and enjoy an outdoor office.

So what do you get when you bring together 40 fourth, fifth, and sixth graders and engage them in such activities as wildlife forensics, wildlife management and law enforcement, wildlife robotics, archery, antlers, skulls, and duck identification? This motley crew of 9-12 year olds brought with them lots of enthusiasm and excitement to learn about conservation, loads of great questions and observations, and a will-

ingness to try some new skills. The camp participants learned and developed game warden skills in real life field scenarios, while partnered up with a real game warden.

One of the goals of the camp was to foster awareness and respect for Alaska's natural resources. For example, we talked about migratory bird identifications, and survey techniques used to count them, fish tagging equipment, and the benefits of the duck stamp program. How about learning a little bit about robotic decoy use in natural resource law enforcement, or looking for clues and using technology to solve a wildlife crime? These opportunities may spark career interests in fisheries and wildlife management, natural resource conservation, or being a game warden, and gives kids a meaningful, fun experience. That's what this camp was all about.



Participants in the 2015 Youth Game Warden Camp learn to navigate in the woods with GPS units and compasses.



Working with two camp participants, Robert Begich (Alaska Department of Fish & Game) steps through a real-life scenario of checking waterfowl hunters on Headquarters Lake.

Youngsters learned archery fundamentals for the proper shooting techniques and safety on the shooting line. Everyone from first time shooters to more advanced archers who showcased their talent were treated to a fun and engaging experience learning skills that some will use for a lifetime.

During boating safety, the ice bucket challenge tested their bravery. The goal was to pick up as many coins as they could in a bucket of ice water and then try their best to zip up a life jacket, demonstrating the effects of hypothermia on fine motor skills.

Asked what they enjoyed about the camp, kids responded with “everything!,” “figuring out what happened to the bear,” “archery,” “air rifle,” “checking duck hunters,” and, “navigating with GPS to find animals or evidence in the woods.”

In order to give the kids a better understanding of wildlife management and law enforcement, the entire camp was conducted by game wardens, fisheries and wildlife managers and biologists, and volunteers. Our partners for this awesome event included the Alaska Federal Wildlife Officers, Friends of the Kenai Refuge, Alaska Wildlife Troopers, Alaska State Parks, U.S. Forest Service, Alaska Department of Fish & Game, National Oceanic and Atmospheric Administration, National Park Service, and the local chapter of 4-H.

2016 is just around the corner...got to get planning.

Kelly Modla is a law enforcement officer at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Nature's first green is gold

by Elizabeth Bella



Leaf-out is imminent for Kenai Peninsula birch trees. (E. Bella/Refuge)

Many of us are engaged this week in the annual spring sport of watching the birch trees begin to leaf out, and anticipating early spring-blooming wildflowers. Golden-green sprigs have already appeared on willows in the form of catkins, the slim cylindrical insect-pollinated flower stalks, and in shoots of grasses, and the first tiny unfurling wildflower leaves.

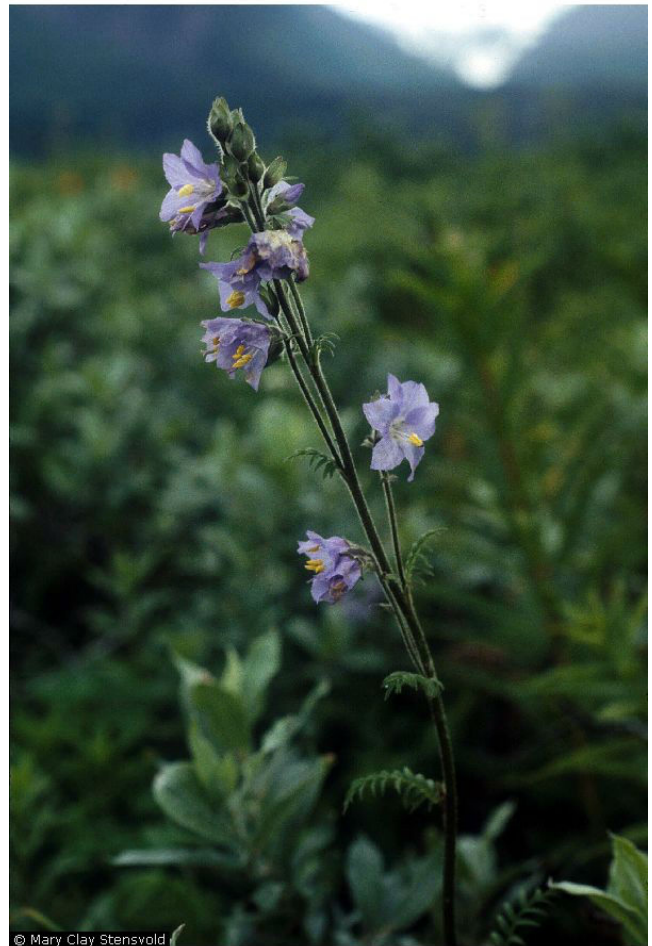
On a warm sunny day, one can almost watch the leaves expand from their very first golden tips to the wide green leaves of summer. Robert Frost's poem, "Nothing Gold Can Stay," captures this fleeting nature of early springtime: "Nature's first green is gold, Her hardest hue to hold. Her early leafs a flower; But only so an hour."

The study and methods of phenology, or the timing of plant and animal life cycle events, has changed in the past few decades, gaining relevance with understanding climate change. Satellite data is now used to monitor leaf-out (or green-up) timing over larger landscapes than previously possible. Leaf-out date has implications for carbon cycles, water availability, and wood production.

Tracking leaf-out dates helps recognize changes over time, but understanding why some trees leaf out first, and others take longer—or why some flowers only bloom for a few days in the early spring, while others bloom much later, or all summer long—remains

a fascinating botanical mystery. Temperature, daylight, microclimate, and the past several seasons' overall weather trends all contribute to each plant's seasonal progress.

Some plants, like the quaking aspen, tend to leaf out all at once at the same time in a large area, as they are often giant genetic clones cued to the same changes in temperature and light. Birch tends to be more variable, leafing out in smaller stands, sometimes varying from hillside to hillside.



Jacob's ladder in all its spring glory. (Courtesy Mary Stensvold, US Forest Service)

For wildflowers on our Kenai Peninsula, producing flowers, fruits, and seeds can be quite a chore. Plants devote lots of resources and energy to grow these spe-

cialized parts in a limited growing season, and will synchronize their efforts with the time of year when conditions are optimal for reproductive success and survival.

A basic floral refresher reminds us that annuals are plants that grow from seeds and complete their entire life cycle in one year. Annuals need to grow leaves and stems before they flower, so they won't flower until mid-summer or later. There are very few examples of true Alaskan wildflower annuals, as the climate is too harsh to allow this type of lifecycle. Many favorite garden plants are annuals, such as cosmos, lobelia, and nasturtium.

Biennials can be confusing as they require two full years to complete their growth cycle. The first year they develop foliage but no flowers; the second year, they flower and produce seed. One Kenai Peninsula example is Scotch harebells (*Campanula* species), common to warm dry slopes with their large purple bell-like flowers and slim dark green foliage.

Perennial plants grow back each year and have evolved many different flowering strategies to avoid competing for the same resources at the same time. Many local species flower in mid- to late summer, accumulating resources part of the growing season. Local perennials include yarrow, monkshood, and our beloved and ubiquitous fireweed.

Early spring wildflowers—just appearing now around the lower elevations of the Kenai Peninsula—store energy in underground roots or stems, allowing them to flower early and quickly. One of the first wildflowers to appear in sunny, exposed places is Jacob's ladder, a member of the phlox family. This perennial has showy, loose clusters of blue-violet bell-like flowers with protruding stamens that extend up above the mass of densely packed leaf stems. The "ladder" portion of its name refers to the well-separated, parallel, ladder-like arrangement of the leaflets. In the Book of

Genesis, these are said to rise along the stem like the ladder of the Biblical dream of Jacob during his flight from his brother Esau.

The scientific name, *Polemonium*, comes from the Greek *polemonion*, a medicinal plant associated with both the philosopher Polemos of Cappadocia and King Polemon of Pontus in ancient Greece. The Greek word *polemos* means war, which is why Pliny the Elder, a Roman scholar, attributed the name to the war created by two kings who both claimed to be the first to discover the plant's medicinal virtues.

A Native American name for Jacob's ladder translates to "smells like a pine," which describes the scent of the root. Native Americans used this plant to make a head and hair wash, and used the roots to induce vomiting and treat skin diseases. In Europe, Jacob's ladder was grown in gardens for centuries because of its recognized medicinal values. Cats are said to be fond of this plant's smell, often rolling on it and injuring it in gardens.

One of the more common species on the Kenai Peninsula is *P. pulcherrimum*, which means "most handsome"—a fitting name as this lovely flower produces masses of bright purple blooms with an enticing scent. You can spot this beauty this week, blooming along the warm and rocky north roadsides of the Sterling Highway in Cooper Landing.

Just as the snowless winter is receding from our memory, soon the early spring days will fade into our typical riot of lush green summer foliage, sprinkled with various colors of wildflowers all season long. Take a moment this spring to appreciate the ephemeral golden beauty of nature's first green.

Dr. Elizabeth Bella is the vegetation ecologist at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Exotic dove continues a steady march north

by Todd Eskelin



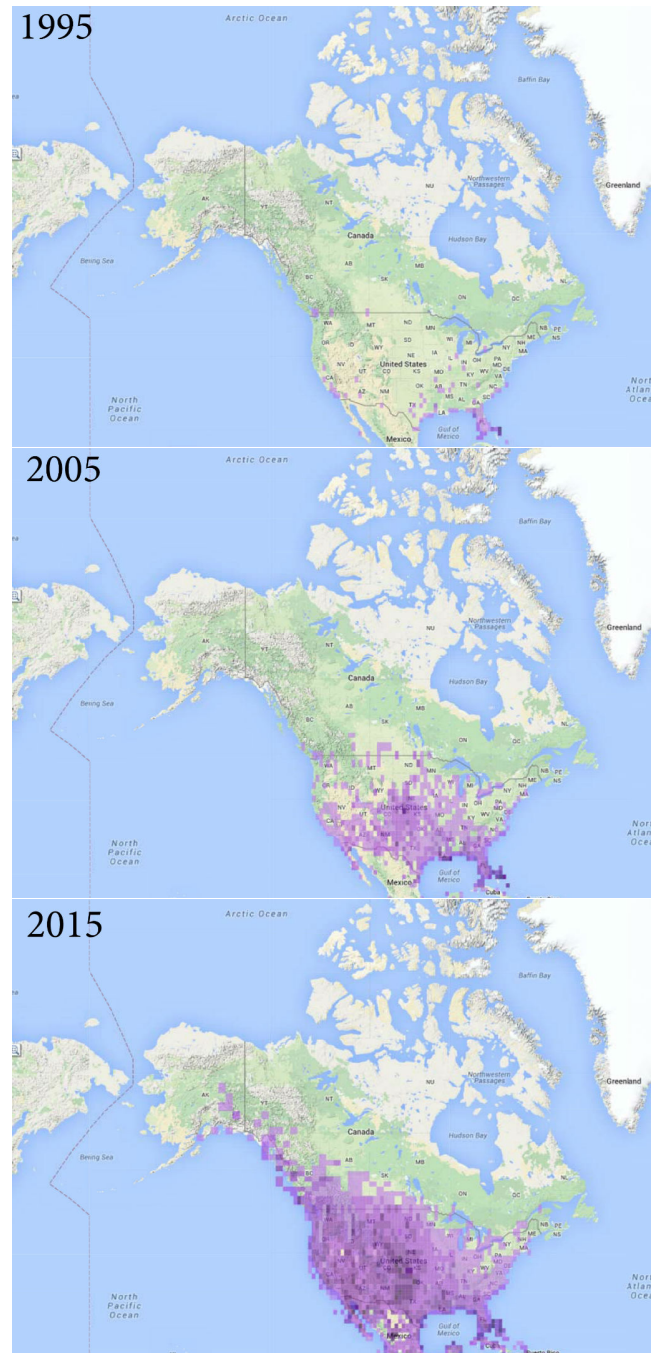
This Eurasian Collared-Dove, the third record of this species on the Kenai Peninsula, was photographed by Mark and Cindy Glassmaker at their house along the Kenai River near Soldotna.

Bird watchers come in all flavors from the hardcore lister to the person who casually watches birds at their backyard feeder. One connection that seems to hold true across all levels is the enthusiasm built around seeing a new species that has never been noticed before. The recent sighting of a Eurasian Collared-Dove on Keystone Drive in Soldotna was no exception. The people who spotted it in their yard were excited as they had never seen one before. Several folks called me as they did not have it on their Alaska or Kenai Peninsula list and wondered if it had been resighted.

This excitement is not surprising—this was only the third record ever for this species on the Kenai Peninsula! The first sighting was in 2009 at Peterson Lagoon on the south side of Kachemak Bay. The second dove showed up last June in Seward and was seen by many who travelled from elsewhere on the Peninsula and Anchorage. Ornithologists have been expecting the arrival of this species on the Kenai for a while now and were surprised it took this long.

The Eurasian Collared-Dove is native to Asia and Europe. It was accidentally released in 1974 in the Bahamas. It reached Florida sometime in the 1980s. From there it has made a spectacular spread westward and northward across North America, finally reaching Alaska in less than 3 decades. Every citizen

science-based project like the Christmas Bird Count and Project Feeder Watch has documented this prolific invasion.



These maps show the rapid expansion of Eurasian Collared-Dove sightings north and west across the United States from 1995-2015. Images provided by eBird (<http://www.ebird.org>) and created 5/12/15.

Viewing the occurrences in eBird (<http://www.ebird.org>) gives you a sense of how quickly it was able to spread. Just compare the counties where it was recorded in 1995, 2005 and 2015. As the dove expands its range, concerns arise about what other birds or other organisms are being impacted by this new invader. It is quite a competitor so species like our native Mourning Dove may be at risk. It is also a known carrier of the protozoan *Trichomonas gallinae*, though this has not been documented as a major disease problem in the U.S. yet.

So how does it do it? How does this little dove colonize so far away from its native range? Who would have guessed that this warm loving bird species that originated on lands surrounding the Indian Ocean would be able to survive the harsh climate of the boreal forest?

In warmer locales like Florida, the dove lays 2 eggs which hatch a little over 2 weeks later. The young fledge from the nest about 18 days after hatching. Then it does that again and again. Often parents are able to produce 3 to 6 broods per year out of the same nest site. Then these offspring continue the cycle and begin their own reproductive careers after their first birthday.

While there is likely nothing that can be done about Eurasian Collared-Doves in the U.S., it should raise a huge red flag for us. Many species have been accidentally or intentionally released, and many have become common place in our lives like European Starlings and the Common Dandelion. But there are

equally dozens of species that are freed every summer in Alaska and fortunately for us do not take off. Alaska is one of the last places in the country where ecological processes are still intact. We have hares eating willows, being eaten by lynx, which are in turn killed by wolves. This food web modifies our natural landscape and is in turn controlled by the landscape.

It would be arrogant to think the loss of one of these cogs—consider Spruce Grouse—in the ecological matrix we call the boreal forest would have no impact or that we could just manipulate the system to accept another substitute. We do our best to document and understand these relationships in nature, but we seem to fail miserably every time we try to change them to benefit us.

So the next time you browse that catalog offering Chukar Partridge and Bobwhite Quail chicks to raise, or perhaps one advertising those beautiful violet Bird Vetch seedlings for your garden, consider how you are going to keep these organisms in control on your property and prevent them from reaching the wild. We will never know which one is the ticking time bomb that takes off or introduces a disease that wipes out one of our native species, permanently compromising the ecological processes that shape our natural world on the Kenai Peninsula.

Todd Eskelin is a wildlife biologist at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

The chaga poachers

by Matt Bowser



The remains of a chaga mushroom that was harvested near the Kenai National Wildlife Refuge Visitor Center, March 16, 2015. Photo credit: Matt Bowser/USFWS. Complete observation record: <http://www.inaturalist.org/observations/1298058>

“Seeking the name of person who cuts chaga from private property and trails established by locals. Blatant disregard for posted signs and trail cameras. Seen...mutilating Birch trees to retrieve his fortune... He is unable to make his own trail on state land so he visits remote cabins and home sites cutting chaga from their land. ... Anyone know of this man, please respond.”

So wrote a Trapper Creek resident this March on Craigslist, but the same is likely happening on the Kenai Peninsula. Corresponding to a rapid growth in interest locally, I have recently been asked more about chaga mushroom (*Inonotus obliquus*) than any other topic.

Most easily-accessible chaga conchs on Swan Lake and Swanson River Roads, as well as along some of our more popular trails, have already been harvested to the point that people have been hauling out ladders to get at some of the higher conchs. I have also heard a report of commercial operations in southcentral Alaska, with chaga gathered for export to the Asian market. At the moment, there is an ad for chaga at \$12/lb. on

Kenai Craigslist, the cheapest price I have seen. The going rate is \$20-\$40/lb. in the Lower 48.

In case you are among the dwindling population of people who haven’t heard about chaga, you may wonder why everyone seems to be chaga crazy. It is the medicinal value of this fungus, an old-time traditional remedy in Russia and other parts of the Old World, that has been driving demand. Unlike many natural medicinals, chaga has become one of the better studied organisms scrutinized by Western Science for its health benefits.

Extracts of chaga have shown demonstrable immune-boosting, anti-oxidant, and anti-cancer properties. I am not going to cover its medicinal uses here, but I encourage the reader to search [PubMed](#) for health-related journal articles on *Inonotus obliquus*.

Due to its growing demand, this slow-growing fungus has been over-collected to the extent that it is becoming far less common in some parts of its range. In response, researchers have developed ways to grow the fungus on artificial media. Unfortunately, these lab-grown chaga mushrooms lack the beneficial medicinal properties of the same fungus grown on wild birch. It turns out that the medicinally active compounds of chaga are made from precursors produced by the host birch trees.

Given the recent chaga trend, I decided that I had to join the bandwagon and try some. I chopped out part of a conch from a birch on my own property, then followed some of the simpler instructions for preparation that I found on-line. I made a simple chaga tea by simmering chunks for several hours on my wood stove, then strained the liquid to yield a dark, mild, smooth, earthy tea. I like it best with a touch of honey to sweeten it slightly, but this is optional as the tea is not bitter. Like so many others, I and the rest of my family have become chaga fans.

Chaga’s second use is as remarkably effective tinder. A friend of mine demonstrated this on Kenai Beach using only a hatchet, a stone from the beach, a chunk of dried chaga, some lichen and birch bark, and a nicely stacked arrangement of kindling. Striking the rock with the hatchet produced a spark that got the chaga going. By blowing on this while hold-

ing it next to lichen and birch bark, he grew the initial ember until nearly the whole chaga chunk glowed and smoked. This served to start the fire with surprisingly little fuss.



A cup of fresh-brewed chaga tea. Photo credit: Matt Bowser/USFWS.

In nature, the chaga fungus is a lethal pathogen of birch. Chaga usually penetrates the tree through injuries to the bark. The fungus then gradually ramifies vertically and laterally through the trunk, causing a white heart rot that eventually kills its host. Mature chaga ruptures the bark of the tree in places, exposing a black, crumbly, charcoal-like mass of fungal tissue.

I must conclude with rules and ethics. As with other mushrooms, it is permissible to harvest chaga conchs on the Kenai National Wildlife Refuge for personal use, but commercial harvest is NOT permitted.

Off of the Refuge, be sure to check rules for harvest on other public lands and obtain permission before cutting chaga from private lands.

Where you do gather chaga, be aware that the conchs take several years to grow back after being harvested, so take no more than you will use. Finally, when chopping chaga, do not damage the host tree's tissues. Take only the fungus. Even though the infection is terminal, the tree may yet fight for its life for decades. Over that time, conchs may be harvested multiple times if proper care is taken.

Matt Bowser serves as Entomologist at the Kenai National Wildlife Refuge. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.



Chaga being used to start a fire at Kenai beach, July 1, 2014. Photo credit: Matt Bowser/USFWS.

Grand opening of *your* new Kenai Refuge Visitor Center

by Leah Eskelin and Candace Ward



A bronze bull moose by artist Stan Watts stands tall, welcoming guests to the Kenai National Wildlife Refuge Visitor Center.



The Center's lobby overlooks the surrounding boreal forest through floor to ceiling windows. The masonry heater's hearth is a welcome place to sit and relax all year round.

Please join the Kenai National Wildlife Refuge staff for a very special occasion—the Grand Opening of *your* new Refuge Visitor Center on Saturday, May 30, from 1 – 5 PM.

At the top of Ski Hill Road in Soldotna, the new Visitor Center sits tucked into the hillside surrounded by boreal forest. The building features a sod roof, solar panels, cozy fireplace and floor-to-ceiling windows offering sweeping views of the Refuge, with Headquarters Lake peeking through the trees.

A state-of-the art exhibit hall welcomes visitors new and old to explore the Refuge from “Icefield to Ocean.” Representing the nearly 2 million acres of diverse habitats found on the Kenai National Wildlife Refuge, the exhibits are designed to be experienced. Climb into a beaver lodge, test your hand against the

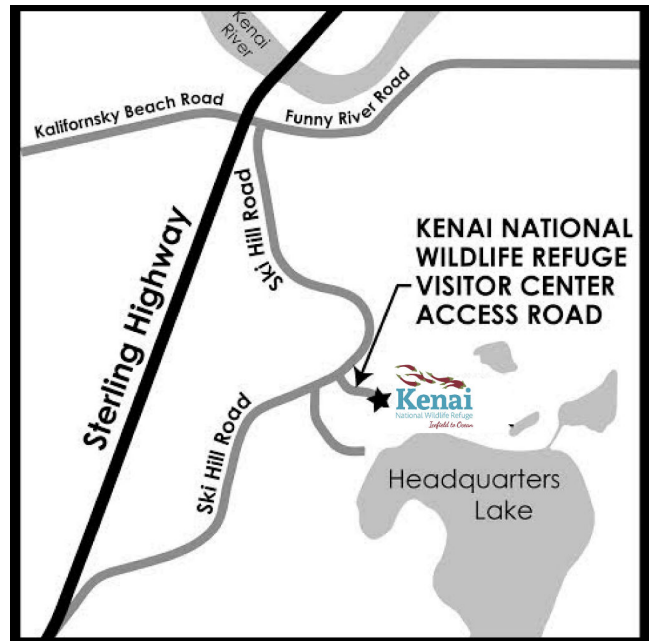
size of a brown bear's paw, and listen to the calls of local birds. Then contribute to our wall of comments and art by answering the question, "How are you connected to the Kenai Refuge?"



Exhibits designed by SplitRock Studios immerse visitors into the diverse habitats of the Refuge from Icefield to Ocean.

To find the Refuge Visitor Center when you arrive in Soldotna, travel to mile 95 of the Sterling Highway, crossing the Kenai River Bridge. Once you cross the river, immediately get in the far left turn lane and make a left on to Funny River Road. As soon as you are on Funny River Road, prepare for an immediate right turn onto Ski Hill Road. Ski Hill Road is gravel, and you will drive one mile up the hill and make a left turn onto a paved road leading to the Visitor Center.

Two million acres does give GPS-based apps a challenge when tasked to pinpoint "Kenai National Wildlife Refuge." To find the Visitor Center on a map app if you are travelling from outside the central Kenai Peninsula, or if you haven't been to visit before, use the building's physical address: 33398 Ski Hill Road, Soldotna, Alaska 99669.



The Kenai National Wildlife Refuge Visitor Center in Soldotna sits at the top of Ski Hill Road. Access it from the Sterling Highway across from Skyview Middle School or from Funny River Road between the go-cart track and Spenard Builders Supply sign.

The Center opens with a celebratory ribbon cutting at 1 PM on Saturday, May 30th. After the doors open, enjoy viewing the new exhibits, special "behind the scenes" presentations, fun family activities, door prizes, and a finale hot dog picnic BBQ from 4 – 5 PM. Enjoy being part of ushering in a new era at Kenai National Wildlife Refuge! See you at the Grand Opening!

Leah Eskelin and Candace Ward, Kenai National Wildlife Refuge rangers and year-round hosts at the new Visitor Center, will be assisted by summer rangers and volunteers from the community and throughout the U.S. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Killing elodea under the ice

by John Morton



Vibrant, green Elodea spews out from an ice-auger hole on Stormy Lake in 2013. Fluridone, an herbicide, can kill this perennial invasive plant even in winter because it apparently continues to photosynthesize under the ice.

Elodea, the first nonnative submersed freshwater plant to invade Alaska, was discovered on the Kenai Peninsula in late 2012. We now know that a hybrid Elodea species, common in the aquarium trade, infests Beck, Daniels and Stormy Lakes north of Nikiski.

The bad news is that Elodea really does have the potential to affect our quality of life. Elodea can grow so prolifically that it can severely degrade fish habitat, reduce dissolved oxygen, hinder boat traffic, and depress property values. And it can be spread easily, transported by float planes and motor boats to new waterbodies, where it reproduces vegetatively.

The good news is that Kenai Peninsula Cooperative Weed Management Area partners have made significant headway towards eradicating Elodea from the peninsula. Fluridone was the primary herbicide used, a chemical that essentially starves the plant by interfering with photosynthesis. The trick is to keep con-

centrations low enough (less than 10 parts per billion) so that it isn't lethal to other more fluridone-tolerant native plants, while ensuring that it is in the water column long enough (45-90 days) to be taken up by Elodea during photosynthesis—in other words, Elodea has to be actively growing for it to kill both roots and leaves.

The problem is that Alaska has a short growing season and cool waters. However, unlike most native submersed aquatic plants in our local lakes, the perennial Elodea does not completely senesce. When Elodea was first surveyed in February 2013, we were stunned to see bright green strands of elodea spew out onto 2-foot-thick ice when the gasoline-powered auger was pulled out. It seems that Elodea, at least the floating strands, can photosynthesize under low light conditions during the winter.

We bet on this unusual life history trait, prescribing four treatments of fluridone over three years. We

applied the first two treatments this past summer, using a pelleted formulation in mid-September with the expectation that fluridone would persist through the winter when Elodea was growing slowly. The disadvantage of relatively low uptake by plants during winter is offset by seasonally low water volume, minimal mixing (no wind due to ice cover), and reduced concerns about potential impacts to anadromous fish and human health.



Kenai National Wildlife Refuge staff apply pelleted fluridone to kill Elodea in Beck Lake last summer. Elodea was present at 35 of 50 sampled sites in May 2014—these same sites now have none.

There is precedent to our own efforts. A 2006 article published in the *Journal of Aquatic Plant Management* described how watermilfoil, another aquatic invasive species, was controlled in a Michigan lake with

fluridone, first applied in October and subsequently boosted in November, with herbicide residuals maintained through the winter.

Did our bet pay off? It certainly seems so. We resurveyed 50 sites in each of the three lakes (150 sites total) last week that had been measured previously in mid-September 2014. At that time, just before ice-in, Elodea occurred on 12 percent and 46 percent of sites in Beck and Stormy Lakes, respectively. This spring, after ice-out, Elodea occurred on ZERO and 20 percent of sites on these two lakes—real evidence that Elodea continued to die under the ice. Our measurements of fluridone concentrations in September, February and this May showed that the herbicide persisted through the winter, although declining with time.

In the case of Daniels Lake, treatment with fluridone and diquat (a second herbicide) had already knocked Elodea down to ZERO by last September (down from 22 percent of sites in May 2014), a measurement that remained ZERO when we resurveyed in May 2015. All evidence suggests our approach to eradicating Elodea from the Kenai Peninsula will be successful.

To get more information about this project, preliminary results and our plans for summer 2015, we are hosting a public meeting at the Nikiski Community Recreation Center on June 11th from 6:00-7:30PM. We encourage you to attend to get your questions answered and concerns addressed.

Dr. John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Kenai Refuge is looking for bats

by Mallory Okuly



Little Brown Bats are the only bat species known to occur on the Kenai Peninsula. This one was captured near Skagway and was tagged with an aluminum band (right forearm in the background).

“Gross” is the response I often get from my mother when I talk about bats. Stories that make me smile usually make her cringe. I’ve had bats sneak out of their bags while tucked inside my waders or start wandering back down my arm rather than off my hand as I’m trying to release them. While bats are quite feisty when handled, not once have I been bitten by an unrestrained bat simply trying to make its escape back into the wild.

Yet despite my adventures, my mom still doesn’t quite view the world’s only flying mammal as the

adorable and fascinating critter that I do. So for those of you like my mom, please allow me to dispel some common myths.

Bats aren’t rodents. Bats are actually more closely related to humans than rodents. They belong to the Order Chiroptera, which means “hand-wing” as their wing bones are comparable to human fingers.

Bats aren’t blind. The insect-eating bats even have an additional sense of “sight” called echolocation. They are able to navigate in complete darkness by listening for echoes of the ultrasonic sounds they

emit. This means that they can “see” better than us and won’t get tangled in your hair.

Bats don’t suck blood. Vampire bats (found in Latin America) only lap small amounts of blood from tiny incisions and feed not on humans, but mostly cattle. They have even benefited humans as the anti-clotting enzyme in their saliva is being used to develop heart medications.

Bats aren’t rabid. Only about 1 percent of bats actually carry rabies and of the hundreds of bats that have been caught in Alaska, only four have tested positive for the virus. When it comes to bats, prevention is easy—don’t touch one and you’ll never be bitten!

The three vampire species make up a small proportion of the more than 1,200 species of bats found worldwide. Bats all over the globe play vital roles in diverse ecosystems ranging from pollinating plants that produce fruit, to dispersing seeds that regenerate forests, to consuming insects considered agricultural pests.

All of the bats in Alaska are insectivorous and can each consume up to 2,000 insects per night. In the United States alone, bats are estimated to be worth \$3.7 billion a year in their reduction of crop damage and the need for pesticides. So whether you realize it or not, we are all impacted by bats and depend on the ecological and economic services they provide.

It is for these reasons that we should all be concerned about the rapid bat population declines. In addition to being threatened by factors such as habitat loss, bats are being wiped out in devastating numbers by white-nose syndrome (WNS). A fungus, WNS wakes bats from hibernation during the winter when temperatures are low and food and water are unavailable.

The disease was first documented in New York in 2006 and has spread rapidly, already being confirmed in 26 states and 5 Canadian provinces. It has killed more than 5.7 million bats in eastern North America

with 90-100 percent mortality rates in some hibernacula. The Little Brown Bat, once the most common and widespread, has seen such dramatic population declines that scientists have recommended listing it as endangered.

The Little Brown is one of seven species of three genera known to occur in Alaska along with the Long-legged Myotis, California Myotis, Keen’s Myotis, Yuma Myotis, Silver-haired Bat and Hoary Bat. While the range of the Little Brown extends into southcentral and interior with records as far north as Fairbanks, the other six have only been documented in southeast Alaska.

So what does all of this mean for us here in Alaska and in particular, on the Kenai Peninsula? There’s a lot to do! Very little is known about basic bat ecology in Alaska, especially outside of the southeastern part of the state. How many species do we have? How abundant are they? What habitats do they prefer? Where do they go in the winter?

Researchers are trying to answer some of these questions in order to address the potential impacts of habitat loss, climate change, and the arrival of WNS. We still don’t know whether our bats are overwintering locally or heading south, and who they mingle with during hibernation could affect whether or not WNS makes it to Alaska—or at least how soon.

Got bats? We want to hear from you! If you have bats on your property or know of a roost, please contact mallory_okuly@fws.gov at the Kenai National Wildlife Refuge. Also, please don’t touch or handle any bats. They are likely to bite in self-defense and, while rare, diseases such as rabies can be transmitted to humans.

Mallory Okuly is a seasonal biotech at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Carnivorous plant common in Kenai lakes

by Jenny Archis



A recent sprout of the flatleaf bladderwort (U. intermedia) from its winter turion, a mechanism for overwintering in Headquarters Lake on the Kenai National Wildlife Refuge. Photo credit Jenny Archis/USFWS.

It's a very unassuming predator—you might even find it pretty. But it can strike in the span of milliseconds, snatching the bug or small fish that had the misfortune of swimming in the wrong place. Meet the bladderwort: a small aquatic plant with a big personality.

Carnivorous plants are a subject of fanciful imagination. From pop culture references to legends of man-eating plants, they seem impossibly unusual. They come across as almost extraterrestrial, turning the notion of “animal eats plant” on its head. Yet they're quite common—the bladderwort is one group out of hundreds of carnivorous plants worldwide.

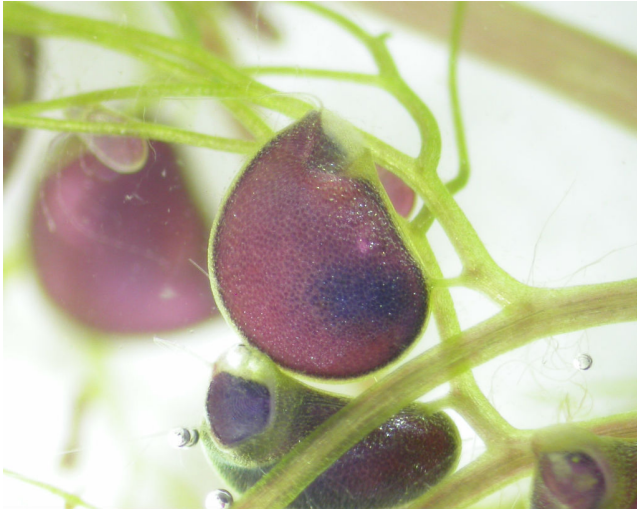
Carnivory by plants is a common adaptation in response to limited nutrient availability, which is why the bladderwort and its fellow carnivores can flourish in poorer conditions than their solely photosyn-

thetic counterparts. It all comes down to phosphorous and nitrogen. Carnivorous plants are able to obtain these nutrients through their prey, while other plants are limited to the nutrients in the environment around them. However, carnivorous plants can still be successful in areas of plentiful nutrients as long as competition is low.

There are three species of bladderwort in Alaska: the common bladderwort, the flatleaf bladderwort and the lesser bladderwort. All three of these are widely distributed throughout the state, including here on the Kenai Peninsula. There is another species—the swollen bladderwort—that experts believe could become invasive if introduced, but it currently isn't known to occur here.

The bladderwort genus, *Utricularia*, is Latin for “little bag,” which refers to the small bladder-like traps

it uses to capture its prey. The opening of each bladder is covered with small hairs that work like triggers. In its resting state, the bladder is closed and flat. When an unsuspecting organism happens to bump these hairs, the bladder swells rapidly like a balloon being inflated, drawing in water and victim alike by vacuum force. The trapdoor closes, leaving the organism imprisoned with no chance of escape. From there, the bladderwort secretes enzymes to break down the organism and obtain its nutrients.



The inflated bladder of the common bladderwort (U. macrorhiza) is used to capture live prey such as insect larvae, water fleas and even small fish and tadpoles! Photo credit Jenny Archis/USFWS.

Aquatic invertebrates such as insect larvae and water fleas are *Utricularia*'s prey of choice but it will also consume small fish if given the opportunity. By small, I mean very small—the bladder of a fully-grown bladderwort is only around two millimeters in size. It's

not uncommon to find small tadpoles and fish halfway inside, with the portion inside the bladder completely digested.

The bladderwort isn't all bite—or should I say—bloat. It's an important piece of nature's puzzle, serving a variety of purposes. Fish often utilize the bladderwort for both food and cover. Muskrats and waterfowl can also be seen munching away at dense patches of bladderwort. Even aquatic invertebrates can use the bladderwort for habitat—they just have to watch where they swim.

In the winter, it hunkers down in the form of a dense sphere of plant matter about four centimeters across called a turion. Because the turion is so dense, it sinks to the bottom of the pond or lake. It will lie there, dormant, for the winter while it waits for warmer waters. Like the bud on a tree, this turion will give rise to the next generation of bladderworts when conditions again become favorable. Once the weather improves, all the plant needs to do is elongate its stem—bladderworts are free-floating, so they do not require roots.

Now, with summer in full swing, the bladderwort is starting to convert to its free-floating plant status. It's difficult to see from the surface because it's a submerged plant, but soon it will begin producing emergent flowers—usually around late summer. Its flowers are shaped like those of a snapdragon and yellow in color.

So while you're out enjoying all the aquatic activities the Alaskan summer has to offer, keep an eye out for a pretty little plant with a pretty big appetite.

Jenny Archis is an undergraduate biological intern at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Legacy of a tiny leg-banded bird found on the Refuge

by Ted Bailey

Thirty-three years ago on June 4, 1982 a husband and wife—the Peralas—decided to take a walk one evening along one of the roads within the Swanson River Oilfield on the Kenai National Wildlife Refuge. The Peralas were living there for the season as facility watchdogs. Along the way they found a small unidentified bird lying dead in the road apparently struck by a passing vehicle. Then they noticed a small aluminum band on its leg with the number 1300-51982. They called our office and I told them to bring in the bird.

I subsequently identified the bird as an orange-crowned warbler and sent the information to the U. S. Fish and Wildlife Service's Bird Banding Laboratory in Laurel, Maryland. Later I received a report on the bird that was, and still remains, fascinating to me even today.

Amazingly, the then young-of-the-year bird was banded 2,182 miles away on September 28, 1976 in San Luis Obispo, California by Fern R. Tainter of the Western Bird Banding Association. Assuming that the bird was hatched in Alaska, probably on the Refuge, this tiny bird weighing less than one ounce, would have flown back and forth between Alaska and at least as far south as California twelve times or roughly a distance of at least 26,000 miles.

What was also amazing was that it was the first banded orange-crowned warbler encountered in Alaska based on records from 1960 through 2014 and, at the time, was the then longest living orange-crowned warbler known at the age of six years. It held that longevity record for orange-crowned warblers for 20 years, until 2002, when another was aged at 8 years and 3 months in California. The current longevity record for an orange-crowned warbler is 8 years and 7 months and is also based on one banded in California in 1995 and encountered there again in 2004.

Orange-crowned warblers are small, rather drab grayish to olive-green birds. Breeding males have a

yellowish breast and their orange crown is very difficult to see. They are generalist feeders eating flies, spiders, beetles, caterpillars and ants but can supplement their diet with fruits, seeds and berries.

Here on the Kenai they are often heard rather than seen because they inhabit thick cover dominated by alders, willows and young aspen. Like many songbirds they migrate at night to avoid predators by using magnetic fields, polarized light, positions of the stars, and the position of the setting sun as directional clues. They breed throughout forested regions of northern North America including Alaska. Some overwinter in central California and the southern United States while others continue migrating south to Guatemala and Belize.

Comparatively little is known about the ecology, behavior and migration of this drab warbler relative to other warblers. For example, the banding of 165,840 orange-crowned warblers in North America from 1960 through 2014 have resulted in only 146 encounters (resightings or band recoveries), and of 26,304 banded in Alaska during the same period only 7 have been encountered. Fortunately, despite a decline across North America of 33 percent since 1968, orange-crowned warblers are still fairly abundant and can be seen by astute observers on the Kenai Peninsula from May through September.

Whenever I see one I sometimes think of orange-crowned warbler number 1300-51982. I wish all orange-crowned warblers well on their future journeys.

Ted Bailey is a retired Kenai National Wildlife Refuge wildlife biologist who has lived on the Kenai Peninsula for over 39 years. He maintains a keen interest in the Peninsula's wildlife and natural history. You can find more information about the Refuge at <http://kenai.fws.gov> or <http://www.facebook.com/kenainationalwildliferefuge>.

Common grass has uncommon attributes

by John Morton



Once spruce-covered hills in the Deep Creek watershed on the Kenai Peninsula were converted to extensive bluejoint grasslands in the aftermath of a spruce bark beetle outbreak and the 2007 Caribou Hills Fire.

Perhaps the most common plant on the Kenai Peninsula is *Calamagrostis canadensis*, the bluejoint reedgrass. This perennial grass grows in dense colonies near the coast and along stream banks. It has become the dominant plant on the slopes around Caribou Hills that were deforested after a spruce bark beetle outbreak in the late 1980s and 1990s. It is interdispersed among the understory foliage in both softwood and hardwood forests, tending to fill in where gaps in the canopy occur. Bluejoint was even found growing on a nunatak jutting out of Petrof Glacier in the southern Kenai Mountains!

Bluejoint's ability to grow in widely varying environmental conditions is not limited to the Kenai Peninsula. It occurs throughout the boreal and temperate regions of North America, common in the subarctic from Alaska to Quebec, and extending southward to all but the southeastern U.S. It extends from sea level in the

north to over 12,000 feet near the southern limit of its range in New Mexico.

It prefers moist sites but can survive in widely varying moisture regimes. While bluejoint cannot germinate under drought conditions, it is very drought resistant once established. It is found on both peat and mineral soils, adapted to a wide range of soil textures ranging from very acidic to slightly alkaline (pH 3.5–8) and is moderately salt tolerant.

What makes bluejoint so robust? Bluejoint is a sod-forming, native, perennial, cool-season grass. In Alaska, it can reach heights of 6.5 feet within 6 weeks. It readily colonizes disturbed areas especially following logging or fire, yet stands are capable of maintaining themselves for several years in permanent standing water up to 6 inches deep. Well-developed fields may persist for 100 years!

Bluejoint flowers are wind pollinated. Flowering

occurs in late June or July and the seed matures in August. The tiny seeds have fine hairs attached at one end of their hull to help them become windborne, and they remain viable in the soil for up to 5 years. Prolific flowering, however, occurs only in wetlands and recently disturbed sites. Elsewhere, bluejoint can reproduce vegetatively, capable of producing an extensive network of rhizomes during a single growing season.

So why do we care? Because bluejoint growing along the urban interface greatly increases wildfire risk, likely contributing to the rapid ignition of the 2014 Funny River Fire and this year's Card Street Fire. For many years, May 1 was the official start of the Alaska fire season, but it was changed to April 1 in 2006 largely because of the increasing threat of "pre-green up" grassland fires in the aftermath of the spruce bark beetle outbreak on the Kenai Peninsula. The year before, in 2005, the Tracy Avenue Fire near Homer started on April 29, burning 5,400 acres in what was described by the Division of Forestry's director as the "earliest large complex fire in the state's history."

Since then, the peninsula experienced three other grassland fires that burned significant acreage. The Caribou Hills Fire began in June 2007 when sparks from a shovel being sharpened by a grinder ignited dry grass, eventually burning 55,400 acres and almost 200 cabins, homes and outbuildings. The 260-acre Homestead Fire near Clam Gulch burned 260 acres in May 2008. The Mile 17 Fire near Homer torched over 1,000 acres and 8 structures in mid-May 2009 after a downed power line ignited dry brush.

What these fires have in common is they were human-caused and started in grasslands, composed primarily of bluejoint, during spring. Much of what was mature white and Lutz spruce forest on the southern peninsula is now bluejoint grasslands with few

spruce seedlings. This has prompted our local fire management community (All Hands/All Lands) to evaluate different treatments for reducing bluejoint in the wildland-urban interface.

As with most things in life, there is a silver lining. Bluejoint is forage, particularly when young and succulent, for livestock in Alaska and as an important food for bison in the Northwest Territories. Elsewhere, deer graze lightly on bluejoint but elk feed heavily on it during winter. Here on the Kenai, John Oldemeyer and his colleagues at the Moose Research Center showed that bluejoint was fair in energy value but poor in protein content for moose.

A study coauthored by investigators with the Kachemak Bay Research Reserve showed that bluejoint, acting as a "keystone" species, reduces riparian vegetation diversity by outcompeting other native flora. On the other hand, visiting scientists from Minnesota and Washington thought our sod-forming bluejoint was preventing the rapid spread of reed canary grass, a nonnative invasive species that threatens salmon habitat in nonglacial streams. Within headwaters streams of the Kenai Lowlands, Baylor University researchers found that decaying bluejoint litter provides the carbon input that increases the abundance and diversity of aquatic macroinvertebrates.

All of these uncommon attributes make for a very interesting albeit common plant. In our rapidly warming world, it appears to be spreading on the Kenai, filling in right-of-ways and slowing regeneration of our burned and beetle-killed spruce. You may as well get to know it.

John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Bird cherries on the Kenai: a preview

by Matt Bowser



European bird cherry (Prunus padus) in blossom in a Kasilof wetland, June 1, 2015.

Earlier this summer as I walked the beach north of the Kasilof River mouth, I did a double-take as I passed a shrub that seemed out of place in this lush wetland adjoining the beach. It was a mayday tree, a.k.a. *Prunus padus* or European bird cherry. A little poking around yielded more cherry trees peppered throughout the wetland including larger individuals in full blossom.

This was a preview of what may be in store for stream corridors and moist woods on the Kenai Peninsula. European bird cherries have already spread extensively along streams in the Anchorage area, out-competing native willows and alders to become the dominant species lining many stream stretches, in some places forming pure stands of cherries. Infestations have also been found in Fairbanks and in southeast Alaska. On the Kenai Peninsula, bird cherries are just starting to escape into the surrounding wilds in Hope, Homer, and Kasilof.

European bird cherries are popular landscape trees in Alaska for good reasons. They grow quite well in our climate and in our gardens because moose generally do not eat these trees. In spring they produce abundant showy, fragrant blossoms. In late summer the fruits are highly attractive to birds.

Many species of birds partake of the fruits, giving the bird cherry its name. In exchange for feeding the

birds, the trees receive a seed dispersal service. Robins, for example, swallow the small cherries whole, then usually flit to a nearby protected perch to regurgitate the cherry stones.

Moose prefer other shrubs, but they will resort to eating cherries in hard winters when other food plants become scarce. Unfortunately for moose, European bird cherry foliage contains cyanogenic glycosides, which has led to the deaths of several moose in Anchorage by cyanide poisoning in recent years. On a larger scale, a bigger concern for moose is that invasive cherries have the potential to outcompete and replace their preferred willows, at least along streams.

The effects of bird cherries on salmon and salmon stream food webs are not yet clear, but the cherries do not appear to benefit salmon. A study in Anchorage streams found that European bird cherries supported a lower biomass of insects than native trees and shrubs, suggesting that they may provide less potential food for salmon fry than native vegetation. Replacement of nitrogen-fixing alders by cherries could also lead to lower overall stream productivity.

Historically, people have harvested the small, astringent fruits of *Prunus padus* for eating fresh and for preserves, but it appears that people generally prefer to use other fruits over bird cherries. I failed to find any recipe using bird cherries.

Expect to hear more about this species in the future. While *Prunus padus* has not yet made the Alaska Department of Natural Resources' list of Prohibited & Restricted Noxious Weeds or the UAF Cooperative Extension Service's DON'T Plant in Alaska list, it received a high invasiveness ranking (74/100) from the Alaska Natural Heritage Program. An article from the Alaska Department of Fish & Game's website stated that the Alaska Department of Natural Resources was moving to list *Prunus padus* as a prohibited plant.

In the Anchorage area, systematic removal of bird cherry is well underway by mechanical and chemical means. This June marked the Kenai Peninsula's first effort at removing bird cherries when a group from the American Hiking Society spent a day pulling bird cherries around the Hope Museum.

We are close to the decision point regarding

whether or not bird cherries should be allowed to become a permanent part of our streamside plant communities on the Kenai Peninsula. We are presently within the time window when it is still realistic to eradicate and exclude bird cherries from the Kenai with relatively little cost.

It may yet be possible to exclude bird cherries from our flora because birds generally do not carry cherry seeds far. This is in contrast to wind-dispersed weeds like dandelions, where their introduction is essentially irrevocable once they have become established.

Once bird cherries have dispersed up our stream corridors into less accessible areas, it is reasonable to expect that bird cherries will permanently become a substantial and ubiquitous part of our streamside communities, making the Kenai a little more like Europe, a little less like Alaska, and perhaps a little less special.

Matt Bowser serves as Entomologist at the Kenai National Wildlife Refuge. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Eat your peas—just not the ones you find in the wild

by Jenny Archis



A sprout of Eskimo potato (*Hedysarum alpinum*) outside of the Kenai National Wildlife Refuge visitor center. The Eskimo potato looks strikingly similar to the poisonous wild sweet pea, *Hedysarum mackenzii*, found in interior Alaska. Photo credit Jenny Archis/USFWS.

The story “Into the Wild” is one of the most wildly popular Alaskan stories out there. Whether you follow the story with a sense of wonder and envy, or can’t help but scoff at the decision to take off into the wilderness with less than a day’s worth of food, you’ve undoubtedly heard the story. Man leaves the confines of society and dies 113 days later in a bus outside of Denali. The official reports? Death by starvation.

Today, however, we have a different picture of what happened. And it’s one that can be readily applied to our own backyards.

The Eskimo potato, *Hedysarum alpinum* or alpine sweetvetch, is a hardy little plant that grows across Alaska and into northern Canada—including here on

the Kenai National Wildlife Refuge. It’s identified by pea-shaped flowers that range from light pink to purple. It has an edible carrot-like root that has been used as a food source, raw or cooked, by many Alaska Natives and live-off-the-land subsistence folk.

Apparently, you just shouldn’t eat the seeds. One of the last entries in McCandless’ journal seems to incriminate Eskimo potato seeds as the reason for his apparent starvation. For quite some time, it was believed that McCandless made the mistake of eating a wild sweet pea, *Hedysarum mackenzii* or bear root. Eskimo potato isn’t known to have alkaloids, but wild sweet pea is—it’s highly toxic. The two plants are extraordinarily similar in their appearance. They’re easiest to tell apart in the summer while in bloom—Eskimo potato has smaller flowers. It seems like a pretty reasonable explanation for McCandless’ death, right?

Things actually get a whole lot more complicated. In a paper called “The Silent Fire” written by Ronald Hamilton, there is a description of a World War II concentration camp in Vapniarka, Ukraine. In the camp, prisoners are fed bread made from *Lathyrus sativus*, or grass pea. The prisoners at the camp were reported stricken with a condition called lathyrism, which causes weakness and paralysis. The symptoms stem from an amino acid known in shorthand as ODAP. But the most intriguing part? The grass pea, wild sweet pea and Eskimo potato are in the same family, Fabaceae.

Now, that’s not to say that all Fabaceae are poisonous. The Fabaceae family contains some of the most important food plants out there—including soybeans, beans, peas, chickpeas and peanuts. We eat plenty of them every day. That peanut butter you smothered all over your sandwich isn’t going to suddenly strike you dead from ODAP or anything of the sort—unless you’re exceptionally allergic, but that’s a whole different issue that I can’t exactly help with. However, less cultivated species of Fabaceae plants can have alkaloids in their seeds that make them indigestible—even the lupines that are so common here on the Refuge are packed with them. But amino acids weren’t on the radar when initial investigations into McCandless’ death were ongoing. So could this

be the answer? Almost.

Analysis of the Eskimo potato came back with an amino acid all right, but not ODAP. It was an amino acid called L-canavanine. It's pretty similar to a common amino acid in all of our bodies, arginine, so it can trick the cells into taking it up. And it's another common toxin in the Fabaceae family used in predator protection. If you're an herbivore that tries to eat a plant packed with toxins, it's a mistake you won't make twice.

Now, before you start to panic about how many different plants could kill you out there in the wilderness, I'll say this: neither wild sweet pea nor grass pea is known to be here on the Refuge. There are two different species of pea here, the beach pea, *Lathyrus maritimus*, and the vetchling, *Lathyrus palustris*. Neither of these is known to be innately poisonous. In fact, beach pea seeds are edible. You should still be careful though—they can take up toxins from the soil around them pretty readily.

So whether we've solved the mystery of McCandless' death or not, there's one thing to be said: go easy on the Eskimo potato, and don't go munching willy-nilly on plants. We learn new things about them every day. Don't be a teachable moment.

Jenny Archis is an undergraduate biological intern at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.



*The beach pea (*Lathyrus maritimus*) is one of two pea species on the Kenai Peninsula. The other species is vetchling, *Lathyrus palustris*, and neither is known to be poisonous. Vetchling is found in wooded areas while the beach pea is found along the shore. Photo credit Jenny Archis/USFWS.*

At a loss for what to do? Camping opportunities galore

by Nick Longobardi



Many campsites on the Refuge include picnic tables and fire pits for campers to utilize during their stay. These sites at Upper Skilak await campers this weekend! Photo credit Nick Longobardi/USFWS.

Whether you enjoy lounging around listening to a babbling creek in Upper Skilak Campground, watching a colony of beavers collect logs for their lodge on Hidden Lake, or reeling in the biggest fish of your life out on Skilak Lake, the Kenai National Wildlife Refuge campgrounds can provide all of your recreational needs.

In an area saturated with camping opportunities, the Kenai National Wildlife Refuge grants a unique opportunity for all of us to experience the Kenai Peninsula's grand beauty. The Refuge contains many smaller (and free!) campgrounds including Watson Lake, Kelly Lake, Engineer Lake, Rainbow Lake, and Dolly Varden Lake. In addition, it also houses two larger campgrounds at Hidden Lake and Upper Skilak Lake where you will never pay any more than \$10 a night.

The Refuge is a very unique place due to the fact

that it is one of the few National Wildlife Refuges to have an abundance of developed campgrounds, giving us a chance to really get one-on-one with Mother Nature. There are over 130 campsites on the Refuge, not even counting the remote sites in the Swanson River and Swan Lake Canoe Systems. Campsites are very popular and fill quickly on summer weekends, but during week nights there is plenty of space for everyone.

Each of our developed campgrounds has pit latrines which are checked and cleaned periodically throughout the week by our ranger and maintenance staff. Each campground has a boat access with large launches for trailered boats on the bigger lakes such as Hidden Lake, Skilak Lake, and Dolly Varden Lake, or lake access for kayaks and canoes at Engineer Lake, Lower Ohmer Lake, and Petersen Lake. These water experiences make it easy to interface with nature, not to mention the countless nearby hiking trails. What-

ever your camping style may be, it's available here on the Refuge.

But perhaps the best part of the campgrounds is that even with all of these amenities, you don't have to sacrifice your wildlife experience. As a ranger who has worked and recreated in these campgrounds, I've seen no shortage of amazing things.

For instance, I was kayaking on Hidden Lake one evening when I spotted a large figure swimming in the water. It was too large to be a beaver, so I moved in for a better look. As I paddled closer I was able to see that it was actually a black bear swimming across the lake. I watched it climb out on shore, look at me and drip dry for a few seconds before it climbed up the mountain.

Another time, I was out on patrol in Upper Skilak when I spotted something behind the tall grass. It was a lynx on the hunt for some voles, crouched and ready to pounce. It caught me looking at it for a few moments then wandered into the brush.

So please, come enjoy the Kenai National Wildlife Refuge and all it has to offer. Stay for a day or a week, and create your own memories, as I and millions of

others have over the years. There is no telling what you will find or see when you visit.

Nick Longobardi is in his second season as a Park Ranger at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.



A beautiful postcard shot of the boat launch at the Upper Skilak Campground, one of many lakes with boat trailer access on the Kenai National Wildlife Refuge. Photo Credit Nick Longobardi/USFWS.

The Kenai Peninsula rediscovered

by Nate Perrine



Sockeye salmon returning to Bear Creek are one of those special events in nature that occur every season in the Kenai National Wildlife Refuge.

Browsing through my grandfather's stack of *In-Fisherman* magazines as a boy was the first time I had ever heard of the Kenai River. At the time, my life was consumed with all things fishing. Most of my summers were spent at the local park catching half-pound stocked rainbow trout or fishing other lakes and reservoirs in Colorado with my grandparents on camping trips.

The images and stories of fisherman holding giant salmon along the banks of the Kenai with brown bears in the background and giant smiles on their faces

made me dream of coming to this place and trying to catch one for myself. My young mind couldn't even fathom how much of a thrill it must be to have one of those monsters hooked to the other end of your line. I pictured myself as a young Captain Ahab battling the salmon version of *Moby Dick*, on a boat, in a storm, and yelling "Arghhhh!" crassly.

Life is a strange thing—it leads you to places you never even dreamed would be possible. I have recently found myself as a new employee at the Kenai National Wildlife Refuge, where I work as the Fire Operations

and Prescribed Fire Technician.

When I saw the Kenai for the first time, the feeling that went through me was indescribable. It was a soulful moment. The blue-green water that is so brilliant even to a semi-colorblind person such as myself is something that every person should see to really gauge just how rare and special of a place this is. *In-Fisherman* magazine is fantastic but their photos and words barely scratch the surface of the true depth of this land.

I look forward to experiencing all that the Kenai Peninsula and the Refuge have to offer. The list of possibilities is so immense that it is somewhat overwhelming to decide what to do first. But of all the problems in Life, this is one problem that visitors to the Refuge are blessed to have.

Although I have only been here less than three weeks, my list of “firsts” has already been whittled down considerably. The wildlife and landscape viewing is fantastic! I have seen numerous moose (the first of my life!), coyotes, porcupines, glaciers and mountain goats, and leaned out of a helicopter to watch spawning salmon struggling upstream. I look forward to all the things I am bound to see in the future.

I also caught my first sockeye salmon. I have always had a tremendous amount of respect for wildlife,

but something about these fish in particular sticks in my mind. My initial thought that 20-pound test line on a reel with the drag cinched down tight would haul in a four-pound fish with ease was dead wrong. After hooking my first red, and then watching helplessly as my line scorched off the reel, gave me a real taste of the power and tenacity of these fish. Mother Nature is amazing—these fish will stop at nothing to reach their goal, and my hat is tipped to them.

I feel so lucky and grateful to be able to do the job I do now. The challenges faced by the Refuge and other land management agencies to conserve habitats, while also balancing the protection of life and property, is a monumental task. I look forward to contributing to the management of this land in any way I can.

Hopefully, other eight year olds (or 80 year olds!) will be able to see this place in much the same way as it is now long after my time here is over. Maybe by then there will be a word that can accurately describe the feeling that one has when arriving here for the first time, but I doubt there ever will be.

Nathan Perrine is the new Fire Operations and Prescribed Fire Technician at the Kenai National Wildlife Refuge. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Local kids do big work

by Michelle Mulder



Left to Right or Back to Front; Nathan Lervold, Talon Musgrave, Atom Skeebe, Elizabeth Keys and Amber Hamar repair benches used for outdoor educational programs at the Kenai National Wildlife Refuge Headquarters.

This year's Youth Conservation Corps program has come to an end. Every summer a few lucky, randomly-chosen local high school students apply for positions to help maintain the Kenai National Wildlife Refuge. The YCC contributes to conservation work even as it engages participants in learning about their environment.

We help maintain trails, prevent streams from erosion, improve public use areas due to the normal wear and tear it sees every year, and learn about the Refuge. The YCC crew works with everyone on

the Kenai Refuge (Trail Crew, Environmental Education, Cabin Restoration and Biology) to maintain nature and wildlife opportunities for outdoor enthusiasts, whether they are locals or tourists.

Throughout this summer, we had a variety of tasks and projects. The goal was to not only thoroughly maintain but to enhance whatever we were working on.

Rerouting and enhancing the Skyline Trail was our big task this summer. Perhaps the busiest trail on the Refuge, this was a project that will reflect our work for

many years to come. We helped volunteers from the Student Conservation Association (also high school students) dig the new tread for Skyline Trail. The hike up to the beginning of the reroute was difficult for some of the YCC members in the beginning, but closer to the end of the season it was smiles all around. When we arrived, we started the reroute by removing all of the organic material, or “duff,” until we hit rich mineral soil. Once mineral soil was reached, we removed the protruding roots.



Left to Right; Nathan Lervold, Amber Hamar and Talon Musgrave with a representative from the Kenai Watershed Forum help restore a bank by anchoring a spruce tree on the Kenai River.

One of the big accomplishments on the reroute was helping the Refuge Trail Crew create a stone stair case so that uphill travel was easier, conducive to an easy flow of rain runoff, and preventative of erosion. We agree that the Skyline Trail is an amazing trail to hike and climb, although bits of the hike may be difficult to do—at the end it’s completely worth it!

We also did maintenance on scenic nature trails near the Refuge Visitor Center on Ski Hill Road. This new facility has become quite an attraction for the general public. As a result, the Keen-Eye Trail located nearby was in need of a more durable surface. To make the part of the trail that connects the Visitor Center to Headquarters Lake ADA-accessible and long lasting,

we efficiently replaced the existing pea gravel with recycled asphalt.

The most tedious task the YCC had this summer was mulching other segments of the Keen-Eye Trail. We reused some of the downed trees from the Card Street Fire as mulch. We first acquired piles of the mulch from the Skilak Lake Loop road by shoveling it into trucks and bringing it back to Refuge Headquarters. With the help of the Trail Crew, we used wheelbarrows to transfer the mulch to desired locations on the trail. It’s funny that what might look like a big pile of mulch actually disappears very quickly when you start spreading it out on a trail.

One of our favorite contributions to the Refuge was helping to restore its public use cabins, which are a great attraction to tourists and locals. The astonishing thing about some of these structures is that they are historic cabins—they are restored to match the original construction from early pioneer days, and yet they are open for public use. We got the opportunity to help restore and maintain the Doroshin Bay Cabin which was awesome because not only will our work be appreciated in the future, it also helped restore all the work that was put into the cabin in the past.

Another highlight of the summer was spending time in the Swan Lake and Swanson River canoe trails. Using hand tools, we reconstructed degraded portage trails, as well as rehangng missing canoe portage signs. We enjoyed knowing that our work will assist canoeists, hunters and anglers in their outdoor activities. While there was hard work involved, it also meant that we got to enjoy these fun, happy, serene and relaxing places—a good reminder of the opportunities the Kenai Refuge holds.

We spent a lot of time this summer out on the trails, sometimes on ones which we had never seen or even heard of before. We personally invite you to get outside, hike the trails, to take advantage of our work and to enjoy the wonders of our Refuge!

Michelle Mulder is the seasonal Youth Conservation Corps coordinator at the Kenai National Wildlife Refuge. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

A different way to think about climate change

by Dylan Beach



Glacial waters from the Harding Icefield support many of the salmon streams on the Kenai Peninsula. When should we start thinking about a world in which it has melted away?

Do we look for convenient justification to do what is easy, to avoid tackling complex problems? Albert Einstein claimed that if the world depended on him solving a problem in one hour, he'd spend the first 55 minutes devising the right question to ask. I was left with the above question after spending my summer as a U.S. Fish and Wildlife Service Directorate Fellow at the Kenai National Wildlife Refuge.

I chose to approach this problem by interviewing 13 people who represented the Alaska Department of Natural Resources, Cook Inlet Region Inc., Kenai Peninsula Borough, National Park Service, U.S. Fish and Wildlife Service, and U.S. Forest Service. Together, these participants make resource management decisions, or permit public use, on roughly 80% of the Kenai Peninsula. That's why I spoke with them.

Our conversations were about—no, no, don't say it...climate change. Have you already moved on to

another article? If not, great. Specifically, we talked about roadblocks to adapting to climate change on a peninsula-wide scale.

By “adapting” or “adaptation” I mean management actions that help reduce the impacts of a warming climate. So we might plant lodgepole pines to reduce increasing fire risk near the urban interface, or buy riparian land parcels that seep cold water into nonglacial streams that are increasingly reaching lethal temperatures for salmon, or increase the diameter of road culverts to accommodate increasing storm rainfall events. These are, in fact, actions that are already taking place on the Kenai Peninsula!

Adaptation is different than mitigation, which are actions to reduce greenhouse gas emissions. Adaptation is different than engagement, which is working with others to seek solutions to climate change and/or communicating climate change effects to the public.

But what did we really talk about because that, by itself, sounds terribly dry. At the end of the day, the interviews consistently broached the idea of having control over actions and outcomes. A USFWS employee said, “things like the agency’s own carbon footprint we perhaps have more immediate control of than some of our adaptation challenges.” Do we look to reducing greenhouse gas emissions because it is more important in the near term or because it is more manageable?

Interviewees made comments such as climate change “is important, but how do I get today’s job done?” Again, do we pursue mitigation because, with mounting priorities, it is easier to fit changing an incandescent bulb to an LED into our day than, for example, to design and implement a multi-jurisdictional plan to reforest part of the Kenai Peninsula?

“Park Service’s perspective is that climate change is happening and what can we do to assist in at least slowing it down from a one-person-at-a-time perspective. [Kenai Fjords National Park] is a park where you can see that it is happening first hand.” With 296,000 visitors during an average year between 2010 and 2014, they see opportunities to change behaviors, building mitigation (and ultimately adaptation) from the ground up.

What little adaptation that has been done has focused on infrastructure such as trails, cabins, and the few roads that exist—again, focused on manageable items. If we are wrapped up in thinking along the lines of “how much effort goes into how much progress?” then how do we tackle super complex issues like landscape-scale climate change adaptation?

However, what I’ve said above dramatically oversimplifies the issue. There are other, real challenges that cannot be ignored. For example, it’s difficult to have a unified approach to climate adaptation when different agencies have different missions. Much of the eastern side of the Kenai Peninsula is coastal rainforest and is forecasted to remain so for at least the remainder of this century, clearly reducing the urgency to adapt from the perspective of Chugach National Forest. Remoteness of parts of all three federal conservation units also poses challenges for implementing landscape-scale adaptation.

Funding is obviously tied to recognized priorities. An Alaska DNR manager said, “[climate change] hasn’t become a priority for the State.” Likewise, a

Borough representative said, “[Climate change] needs to be driven by a recognition from citizens and the public—that will lead to policy makers who can affect that type of change and make it a priority.” In a similar theme, CIRI prioritizes projects that will show shareholder returns. This does not always align with climate change adaptation (although it can).

Despite the barriers mentioned (and there are others), a rapidly warming climate is a recognized issue. A majority of interviewees said climate change is real, its effects are being accelerated by humans, and humans therefore have a moral responsibility to address those effects.

What we can say with certainty is that climate change on a landscape-scale is a big, hairy issue to tackle. We need to give it a haircut and reduce the feeling that it is too complex to address. First, the issue needs to be personalized so that people understand how climate changes might affect their lifestyle.

Second, rather than discuss climate change explicitly, the issues should be reframed. Participants mentioned salmon, coastal erosion, and fire as examples of unifying issues tied to climate change. Redirecting the conversation towards economics and risk would give climate change impacts broader receptiveness. Gaining broader public support could make climate change a priority for the Borough and the State, potentially rendering them more willing partners in collaborative adaptation.

Once more folks are on board, what then do we do? We still have a lot to learn. A USFWS participant said, “There is a need to start putting some of this stuff in black and white, documenting where we’re at, what we’re thinking, why we’re thinking it, and what possible solutions exist. We need to do this in a cohesive and comprehensive way.” Then, said a Park Service participant, “the key is building on successes. You keep pushing off from the last successful work that you did.”

Targeted collaboration and friendliness between neighbors will lead to a future of healthy, functioning populations of fish, wildlife, plants, and humans. After all, we are all in this together.

Dylan Beach is a USFWS Directorate Fellow at the Kenai National Wildlife Refuge. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Bear Mountain Trail offers photo and berry-picking opportunities

by Nick Longobardi



Panoramic view from the summit of Bear Mountain Trail. Hinton's Knob divides Skilak Lake into two sections. Skilak Lookout and Vista trails climb up opposite sides of Hinton's Knob. Photo Credit: Nick Longobardi/USFWS.



Great view of Rock Lake from only five minutes up the trail. Photo Credit: Nick Longobardi/USFWS.

Is that expensive camera you bought last winter in hopes of becoming a professional photographer just sitting there collecting dust? Or did you just get a new smart phone and need an awesome background picture for it? No matter which device you prefer to capture pictures on, bring it out to Bear Mountain Trail at mile six of the Skilak Lake Road in Kenai National Wildlife Refuge.

Bear Mountain Trail is one of the least hiked trails in the Skilak Wildlife Recreation Area. For some unknown reason, it is easily overlooked. Does the name "Bear Mountain" frighten you off? While Skyline Trail has what seems like half the peninsula's population on it daily, Bear Mountain Trail sits idle waiting for happy hikers to travel up her smooth trail. Being only

0.8 miles from parking lot to summit, it is a short trail with a fair climb of 400 feet in elevation, enough to get any heart pumping. The trail is in excellent condition and hardly ever crowded.

As you climb you will experience stunning views of Skilak Lake. From the top, on a clear day, you can see as far as Lake Clark National Park where Mt. Redoubt is standing tall and proud. You may spot bald eagles floating in the wind as you look down on the Kenai River and Hidden Creek deltas. You can watch from afar as ant-sized boats slowly make their way around Hinton's Knob after a long day of fishing or rafting.

Looking for berries? Take a hike up the trail with basket in hand. There are plenty of raspberries, high-bush cranberries and blueberries for picking. Make sure to hold on to your hats though—the cool breezes from Skilak Glacier rush up the hillside periodically and blow over the peak. Not at all a bad way to cool off after a hike though!

So if you are looking for a new experience this weekend, head out to Skilak Wildlife Recreation Area and take a stroll up Bear Mountain Trail. Remember to dust off that camera—you're going to want it for this trail. Happy hiking everyone!

Nick Longobardi is in his second season as a Park Ranger at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

After the fire

by Kristi Bulock



The aftermath of this year's Card Street fire where it burned along the Kenai River (credit KENWR).

There's a saying in Alaska that when the fireweed stops blooming that the wildfire season is over. This seems to be valid for most but not every year. You see, this saying follows the time of year when nature's ignitor of wildfires, lightning, becomes less frequent and often disappears entirely as a cooler southwest flow of moisture sets up over the state. We are all too familiar with these typical late July and early August rains. If it were not for the occurrence of human-caused wildfires, this saying would hold true.

Did you know that in areas where wildlands and urban interface, such as we have on the Kenai Penin-

sula, the number of human-caused wildfires substantially outnumbers those ignited by nature? Anyone who has been here for the past few years has witnessed the fury of extreme fire behavior associated with human-caused fires such as the 2007 Caribou Hills fire, the 2014 Funny River fire, and this year's Card Street fire. We live amongst vegetation that by its genetic make-up promotes the spread of wildfires—it is extremely flammable, even when green.

Now comes the second saying, "it's not a matter of if wildfires will happen in Alaska, but when." We choose to live in this vast and wild place, largely

because it is just that—wild. Wild means that natural processes, such as lightning-caused wildfires, help keep the fire-adapted boreal forest in balance by recycling nutrients and creating a mosaic of vegetation types. This mix of grass, herbs, shrub and trees provide healthy habitats for birds, hare, lynx, moose and other creatures of the boreal forest. Wildlife benefit from a variety of vegetation types rather than just a monoculture of dense spruce.



Fireweed and shrubs regenerate among weakened trees one year after the fire (credit KENWR).

Wildfires often remove the canopy in patches, allowing sunlight to reach the forest floor and promote the growth of species that lay dormant, and were out-competed by the climax tree species. Vegetation co-

existing in different seral classes is all part of the successional changes that forests, left to the forces of nature, will eventually go through.

Another benefit of lightning-caused wildfires is the reduction of flammable vegetation (or fuels in fire lingo). Burned-over areas act as barriers to future wildfire spread thus lessening the chance of large scale catastrophic wildfires. An example of this was observed when the regenerating forest from the lightning-caused 2005 King County Creek fire checked spread of the Funny River fire as it moved east towards Skilak Lake. Similarly, a large portion of the 2009 Shanta Creek fire did not burn as the Funny River fire encroached upon that area.

What do we see after the fires come through? Well, initially we see fireweed, beautiful and edible. We also see the regeneration of deciduous aspen, birch and willow that moose love to browse in winter. Blueberry shrubs are more productive a few years post fire. But there are dangers afoot in a recently burned area, as we may also see deep ash pits and shallow rooted trees weakened by the loss of the vegetative mat that could topple over with the slightest bit of wind. So please be careful when you are pursuing that perfect patch of morels!

Here we are, once again, near the end of another Alaska wildfire season, and coming into a time of year when we can reflect on the bountiful harvests of summer and fall, much of which would not be possible without balanced ecosystems.

This is also a time to think about how we can help to mitigate the risk of future fire impacts to our property and homes by creating defensible space. Defensible space not only provides a safe place for firefighters to take a stand against wildfire threats, but also allows naturally-ignited wildfires that are not threatening homes or other values to safely be managed as they stimulate vegetation succession. The result: healthy lands that ours and future generations can enjoy, wild areas kept wild, after the fire.

Kristi Bullock is the Fire Management Officer at Kenai National Wildlife Refuge. Find more information about the Refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

The Kenai crusader: tales of a Kenai Refuge intern

by Jacob Heslop



Ranger Jake dissects a salmon at one of his amazing summer camps for local kids at the Kenai National Wildlife Refuge.

People are screaming and sirens are wailing throughout the city. Children are lost, stumbling lone through the streets. Parents and guardians scramble to sift through the hordes of zombie-like children to identify their own. Something is missing; the light has been cast away from their eyes.

A spotlight clicks on. A beacon of hope emerges from the confusion and chaos. A giant “R” is outlined against the clouds. “He’s here!” the people exclaim, “we are saved!” A tall, handsome man adorned in brown tights and a green cape enters the scene. A big “R” lies flat upon his chest. Ranger Jake is here, restoring the connection to nature and serving environmental justice.

The job description for Youth and Visitor Services Intern at Kenai National Wildlife Refuge did not include mobs of nature-deprived children or tights and a cape, but Ranger Jake did not mind stepping up to the challenge, he’s a superhero after all. Crowds of children sixteen strong flocked to his base, the Environmental Education Center, for days at a time. He shared his own fiery passion for nature with them. After a week of education, crafts, activities, and age-old magic, the children left with sparks in their eyes. Over the course of a few weeks (and with a little help from his sidekicks, Rangers Michelle and William) sixty-four children left the base with those sparks, ready to start a wildfire of change across their community.

Apart from leading amazing summer camps, Ranger Jake had appearances all over the city. He popped up at the Soldotna Public Library to talk about animal superheroes and killed it at the Kenai River Festival with fishing safety. Even the grand opening of the Kenai National Wildlife Refuge Visitor Center was graced with his presence. Everywhere he went the winds of change followed him and blew in a new era for the city of Soldotna.

Soldotna was not the only city to have the pleasure of his company. He wandered all over the Kenai Peninsula, connecting with nature so that he could connect others. He met the Harding Icefield, swam with a sea otter in Seldovia, and had dinner with a family of orcas in Resurrection Bay. A delegation was even sent to take him on a backpacking trip to Ptarmigan Creek trail for his birthday. Oh, how he adored nature, and how he loved to share that passion with the people of the Kenai Peninsula.

Then, just as everybody was getting to know and love Ranger Jake, he vanished. People gathered outside his base, but he could not be found. They scoured the trails and the canoe systems, but he was not there. People spent many evenings in the campgrounds and public use cabins waiting for him to join them for a campfire, but he did not show up. The spotlight shined that giant “R” against the sky for hours on end. The citizens of Soldotna grew worried that he was gone for good.

It was at that moment, however, that the hikers and the campers found something, but it was not Ranger Jake. They found their own connection with nature out there in the trails and campgrounds. Instead of only one person promoting stewardship of the land, an entire community stepped up. There was no longer a need for Ranger Jake.

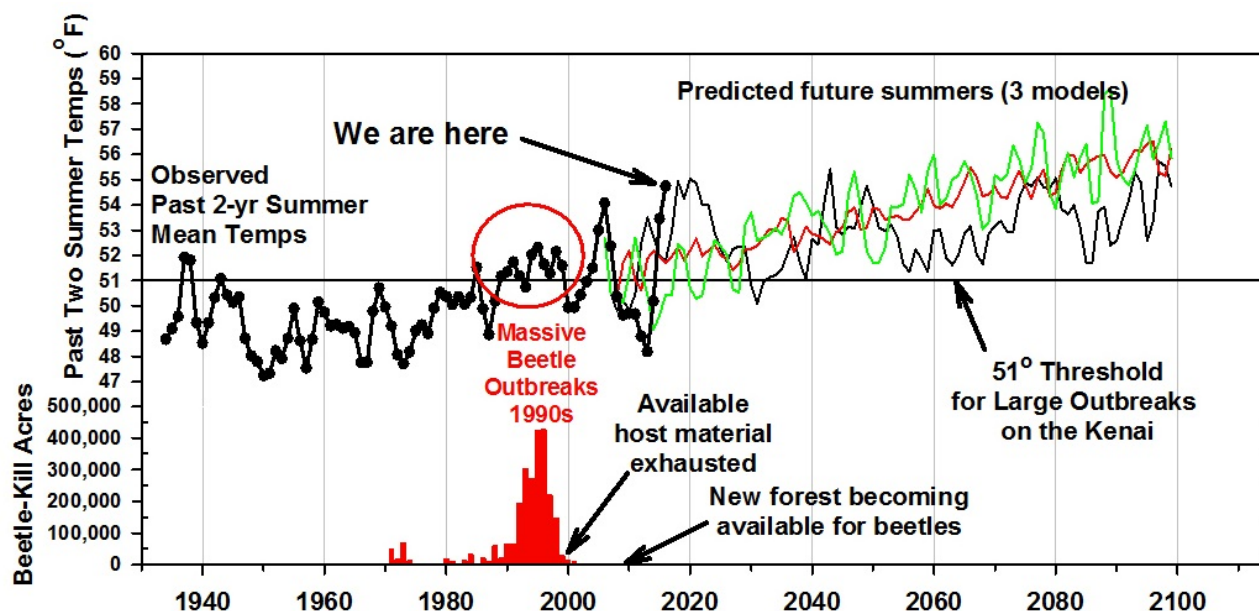
The city still shines the spotlight at least once a month. It is a call for everyday citizens to restore the connection to the outdoors and serve environmental justice. It also serves as a memorial to Ranger Jake, and all the good he brought to such a wonderful community.

Only one question remains—where did such an awesome superhero come from? Some say that he rode in on the backs of caribou. Others say he was born in the fire of Mt. Redoubt, sent by the Earth itself to inspire change. Some suggest he is from another world entirely. Yet, there are a few who say that he is from Ohio, just a normal person with an extraordinary purpose.

Jacob Heslop was a volunteer with the Student Conservation Association from May to August. He will be volunteering directly with the Kenai National Wildlife Refuge through October assisting in Environmental Education and Visitor Center duties. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Warm summers prepare for spruce bark beetle return

by Ed Berg



Global climate models from Germany (green), Canada (red) and USA (black) scaled to the Kenai predict that post-2030 mean summer temperatures will always be above the threshold for spruce bark beetle outbreaks. Observed temperatures are from the Homer airport since 1932. Lower bar graph shows annual beetle-kill for southern Kenai since aerial surveys began in 1971 (US Forest Service). Ed Berg graphic.

If you lived in the woods on the Kenai Peninsula in the 1990s, you may not want to read this article. Those were the years when the spruce bark beetle outbreak killed more than 3 million acres of mature spruce forest on the Kenai. Living out Homer's East End Road my wife and I spent our weekends cutting down our beautiful old-growth Sitka spruce trees and burning the slash. Our view improved dramatically, but so did the cold wind coming up from Kachemak Bay, as well as the vehicle noise from the road.

Spruce bark beetles thrive on runs of warm summers, and the present 3-year run of sunny summers should trigger another burst of beetle activity. My research as an ecologist at the Kenai National Wildlife Refuge during the 1990s focused on the history and causes of bark beetle outbreaks. Using tree-ring analysis (dendrochronology), my colleagues and I developed a 250-year record of bark beetle outbreaks all around Cook Inlet. The last major outbreak was in the 1880s

when many stands on the Kenai and in Katmai and Lake Clark National Parks were heavily thinned, similar to the 1990s. There were smaller regional outbreaks in the 1970s, 1910s, 1850s and 1810s, as well as local outbreaks at other times.

The peculiar ecology of spruce bark beetles allows them to kill only larger trees. Pole-sized trees are spared and are released from competing with neighboring trees to grow rapidly and rebuild a new forest. Bark beetles bore through the outer bark and lay their eggs in galleries within the sugar-rich inner bark (phloem). Small trees not only produce a lot of pitch that can cement the mother beetles in their galleries, Mafia-style, they also have thin phloem that can be too tight for a beetle. Big trees, however, are fat city for bark beetles. The strategy of mass attack allows thousands of beetles to completely overwhelm the tree's pitch defense and eat all the phloem, girdling the tree just as if the bark had been stripped off with an axe.

The phloem cylinder around a tree carries the sugar produced in the needles by photosynthesis down to the roots for storage over the winter. In spring, the sugar comes up as watery sap through the sapwood (the outer several inches of trunk wood) and the sugar feeds the new needles. If the phloem plumbing has been cut by girdling, the sugar never gets to the roots and only zero-calorie sap rises in the spring. The old needles turn red and the tree dies. After a year in the red-needle stage, the needles fall off and only a “gray ghost” of a tree remains.

Two factors control bark beetle outbreaks: adequate host material (enough large trees) and runs of warm summers. The forest gun must be loaded with mature trees, so to speak, and warm summers must pull the trigger. The natural growth of the forest loads the gun, and the El Niño climate cycle provides the runs of warm summers to pull the trigger. A run of cool summers (La Niña) will shut outbreaks down. My research found that there is a distinct temperature threshold for large outbreaks—average May-August temperatures in Homer must be at least 51°F for two or more summers. The last 3 summers have been well above this threshold (2013—52.5°, 2014—54.4°, 2015—55.1°), and the present El Niño is predicted to be one of the strongest on record.

The climate trigger has now been pulled, but is the gun loaded? The gun was very well loaded in the 1990s—foresters considered the forest “overmature,” at least for timber harvesting. The present spruce forest has rebounded quite quickly, primarily through growth release of pre-outbreak understory poles, as well as recruitment of new seedlings. Today’s forest is certainly not mature, but many trees have grown big enough (at least 6 inches in diameter) to host bark beetles. So the gun is at least partially loaded. That said, however, it still may take several summers to build up enough beetles to the point where they can really use mass attack effectively.

Bark beetles are always present at low (endemic) levels in the forest. The USDA Forest Service flies annual aerial surveys for all kinds of forest pests and diseases. This summer’s survey found spruce beetle mortality higher than the last couple of years, but still

low, according to a preliminary report. Red needle acreage was mapped across Cook Inlet between the lower Susitna River and the east end of Lake Clark Pass. A slight increase was seen in the Point MacKenzie to Big Lake area and on the west side the Kenai Peninsula, but still the numbers were low compared to past outbreaks when several hundred thousand acres of fresh beetle-kill were reported every summer.

The future of spruce in southern Alaska seems grim, at least for the upland species of Sitka and white spruce, and the Sitka-white hybrid Lutz spruce. As the graphic shows, global climate models forecast generally rising summer temperatures. After 2030 these models indicate that May-August average temperatures on the southern Kenai will consistently be above 51°, suggesting there will always be beetles attacking spruce large enough to eat. If true, tomorrow’s spruce could be harvested for pulp, but would rarely grow to saw-timber size.

On a brighter note, I don’t expect the next outbreak to be anywhere as severe as the 1990s outbreak for the simple reason that we don’t have the available breeding habitat. Yes, we have some newly mature trees, but only a finite number of beetles can fit into the available phloem. In the 1990s we had forests not substantially thinned since the 1880s, so there was plenty of phloem (and warm summers) to breed enough beetles for many years of mass attack. We’ll likely have warm summers in the future, above the 51-degree threshold, but the endemic beetle population will act like a thermostat that keeps the spruce forest at a new, lower equilibrium. In place of spruce we can expect to see lots more hardwoods, resulting from increased fire activity, which in turn should provide more winter browse for the Giant Kenai Moose, to borrow a term from the 1890s.

Dr. Ed Berg retired as an ecologist from the US Fish & Wildlife Service in 2010. He will teach a course on Global Climate Change at the Kachemak Bay Campus this fall. Homer News published a longer version of this article. Find more information on Kenai National Wildlife Refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Varied Thrush still around on the Kenai

by Dawn Robin Magness



Varied thrush on the Kodiak National Wildlife Refuge. Photo credit: Dave Menke.

Fall is in the air. Last week, I took a quick walk through the woods. I watched golden leaves sail to the ground. A Varied Thrush popped onto a leafless branch in front of me while a small flock of these birds moved along the ground eating berries. I relished the good views.

Varied Thrush are hard to get a look at in the summer. They nest in shaded conifer forests with thick tree and shrub cover. Their distinct song sounds like a single, drawn out note played on a flute. This song carries through the forest, announcing they are present yet invisible. This shy behavior has made them difficult for biologists to study.

If you get a glimpse, they are quite striking. They have black backs in contrast to an orange underside. A black band cuts across the orange chest and an orange brow line cuts through the black. Orange also peppers the wings. They are similar in size to the American Robin, but robins have no orange on the head or wings and lack the breast band.

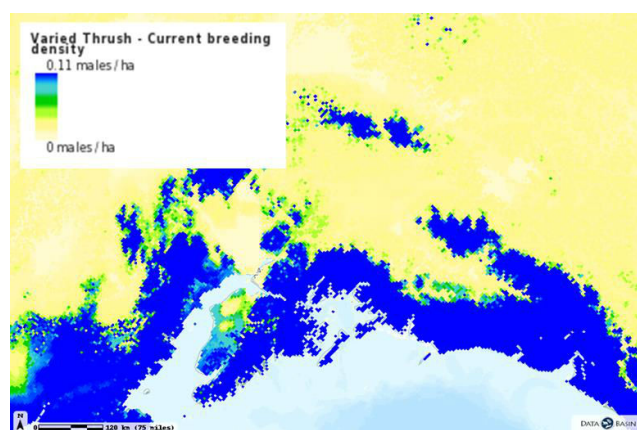
Varied Thrush breed mainly in the boreal and maritime forests of Alaska, Yukon, and British Columbia. The densities of breeding Varied Thrush are highest along the coast. The males sing to attract females and defend their territory.

Female Varied Thrush build nests in the understory of mature forest. Females seem to like to return to the same neighborhood and often build in an area surrounded by old nests. They weave twigs into an open cup that is lined and draped with moss and finally lined with fine grass or soft dead leaves. They lay 1-6 pale blue eggs. Both parents feed the hatchlings, and later the fledglings, insects that they forage off the ground.

The flock I observed was a mix of this year's fledglings and adults. As the berries ripen, Varied Thrush shift their diet from insects to berries. A few hardy birds winter in the coastal rainforest found from Kodiak down to southeast Alaska. However, most of the Varied Thrush move further south to wet forests in Washington, Oregon, and Northern California.

The transition from summer to winter is always bittersweet for me. A nice view of the Varied Thrush was at least minor consolation.

Dr. Dawn Robin Magness is a landscape ecologist and Fish & Wildlife Biologist at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.



Densities of Varied Thrush males singing in the breeding season in south-central Alaska. Map part of the Boreal Avian Modelling Project with data hosted on DataBasin (<http://www.databasin.org>).

More to a bird feeder than just its contents

by Todd Eskelin



A platform feeder with a high roof can attract Pine Grosbeaks, as well as woodpeckers and White-winged Crossbills, to your backyard this winter.

As much as we hate to admit it, winter is approaching. For some of us winter means snow dances, aurora photos, and ski waxing clinics. For others it is the season when it's safe to break out the bird feeders and stare out the window in hopes that some energetic songbird will find our black oiled sunflower seeds palatable.

For years I have enjoyed watching the normal array of chickadees, nuthatches and redpolls grace the bushes surrounding my little "store bought" feeder packed to the gills with seeds. I was always jealous of other folks who showed me wonderful pictures of the Pine Grosbeaks that lit up their yard in the winter with their brilliant red and green hues. I always assumed

it was because I didn't have enough hardwoods or I wasn't close enough to the river. Turns out it was my feeder, and not the food or location, that these large finches were not impressed with.

Years ago I started banding Pine Grosbeaks at a house on Funny River Road. There were reports of eight or ten grosbeaks frequenting a feeder. So I set up a mist net and started banding. In two weeks, I had banded 119 at that location and I became the #2 bander of Pine Grosbeaks in North America that year. I was only a handful of birds behind the top dog from Alberta, Canada. Who knew that little house with the hanging platform feeder could attract that many grosbeaks?

Fast forward 20 years when I decided to match the setup I had seen at the Funny River house. It only took me about an hour to build the new feeder and rig up the system so it was viewable from the kitchen window. A growing red squirrel problem was the instigator for my new project, but in the back of my mind I wondered if I might coax some pine grosbeaks to my buffet. Five days after erecting my new feeder I had a pair of Pine Grosbeaks sitting there plain as day. Coincidence? Possibly, but I really do attribute it to a preference for platform style feeders where the threat of squirrels jumping on them is negligible. They also can see other avian predators like Merlins and Sharp-shinned Hawks coming from a distance.

The setup is simple. Make a small wooden frame (12" × 18") and staple a fine mesh across to dump the seeds onto. The mesh helps keep the seeds dry and reduces cleaning requirements. Build an angled roof over it that is substantial enough to allow the feeder to be hung from the peak. Make sure there is a good gap of 10 to 12 inches between the platform and the lowest point of the roof.

I secured a cable between my deck and a tree about 25 feet from the house. I use a pulley system to pull the platform feeder back to the deck to be restocked and then return so it is 10 to 12 feet from the closest branch on the tree. This keeps the squirrels from jumping to it and it is about 10 feet off the ground so moose can't raid it either during tough winters. Remember to account for any snowfall that may give the moose an ability to reach and then add an extra foot or two in case this turns out to be a year with deep snow (seems unlikely).

Almost from the day I put up the new feeder I have had grosbeaks, several species of woodpeckers, and even some White-winged Crossbills dining. These were species I had seen in the yard for the past three years, but they had never even taken a look at the multiple other styles of feeders I had out. To test it even further, I temporarily replaced my new feeder with the old style feeder on the pulley system for a few weeks. It was like a switch had gone off and all my new birds once again decided to ignore the large quantities of the same sunflower seeds right there at their beak tips.

If you are lucky enough to draw in some grosbeaks, spend some time watching them. They have these massive seed crushing beaks which are ideal for cracking open sunflower seeds. They will just stand there at the feeder, pick up a seed, nibble for a few seconds until the empty shells drop away and swallow the contents. You can easily separate the adults as the males are a bright red color and the females have an olive head and rump and the rest of the body is grey. Younger birds are harder to separate, but you will notice some of the birds have a flame orange head and rump which will eventually turn all red by age two.

No promises that this feeder type will produce grosbeaks for you, but it will certainly improve your chances.

Todd Eskelin is a Wildlife Biologist at the Kenai National Wildlife Refuge. He specializes in birds and has conducted research on songbirds in many areas of the state. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Refuge intern has best summer by far

by William Moore III



Second and third grade participants in this summer's Critter Camp learn how salmon transform as they migrate from saltwater to freshwater enroute to their birth stream.

I didn't know what to expect when I accepted the visitor services internship at the Kenai National Wildlife Refuge. I'm from Oklahoma, also known as the Sooner State. I grew up in a fairly large city so I can't help that I'm a city kid. My supervisor also did a really good job of preparing me for what to expect. I did a little bit of research so I would know what to expect, but research on the internet is so different from when you see things in person and that's definitely the case here.

When I landed in Anchorage, "surprised" isn't quite the word that described how I felt. Coming all the way from Oklahoma, Alaska was a drastic change. The difference in temperature is the first thing that stuck out to me. Living in the south, I'm very used to temperatures over 85 degrees so I was flabbergasted when I landed here in May and it was 50 degrees outside. I've never worn a sweater in the summertime in my life. Secondly, the constant sunlight was quite a shock. It was after 11 p.m. when my flight landed and

it was still bright outside.

Just a quick sidebar, I had to remind myself that some people are just accustomed to cold temperatures because I thought that all the people here surely were crazy—they had on shorts and t-shirts while I had on a hoodie and stocking cap.

After traveling to my duty station at the Kenai Refuge and seeing all of the breathtaking views along the way, I had a sense of what kind of summer was in store for me. I had no idea that Alaska had volcanoes! I saw them on the way to Soldotna and the view was phenomenal. And seeing the mountains in person was a very exciting experience for me.

Working this summer for the Refuge was a way better experience than I ever could've imagined. I worked with Environmental Education Specialist Michelle Ostrowski and fellow intern Jacob Heslop to help conduct summer camps for children. The curriculum focused on the different plants, mammals, insects, fish and birds that are found on the Refuge.



William Moore III, with a handful of morels found during a nature walk, worked as a Student Conservation Association volunteer at the Kenai National Wildlife Refuge.

We conducted two camps, Critter Camp and Get Out & Get Dirty Camp. Critter Camp was aimed towards 2nd and 3rd graders and was based more on arts and crafts. Get Out & Get Dirty Camp was more skill based and was aimed towards 4th and 5th graders. It was very refreshing to see things from their perspective. Our main goal was to show these kids the natural wonders of the Kenai Peninsula and nature in general. With the programs and activities and all of the hands on experiences, students were able to connect with the curriculum on a personal level. Being able to connect with nature through teaching was an experi-

ence I won't soon forget.

In addition to working with children, I also got to spend some time in the field. Fieldwork included but wasn't limited to cleaning trailheads, restocking toilet paper, cleaning up campgrounds, and patrolling the river and backcountry. Doing these tasks allowed me to explore the Refuge. There are lakes and rivers for swimming and fishing, campsites for camping trips, plenty of trails to hike and the views from many of them are simply beautiful.

Being a second-year intern with the Student Conservation Association (SCA), this refuge is so different from my first refuge. Last year, I interned at the [Anahuac National Wildlife Refuge](#) in Texas and I spent my summer on the Gulf of Mexico, which is drastically different from the Kenai Peninsula. I spent that summer surrounded by snakes and alligators, while this summer I was surrounded by moose and bears. It was very hot and humid on the Gulf coast while it's way cooler in temperature here on the peninsula. Needless to say, I've had some great experiences from both places.

Just to share some information with you, the SCA (<http://www.thesca.org>) works hand-in-hand with different government agencies, such as the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and the National Park Service, to provide internships to students like myself and Jacob.

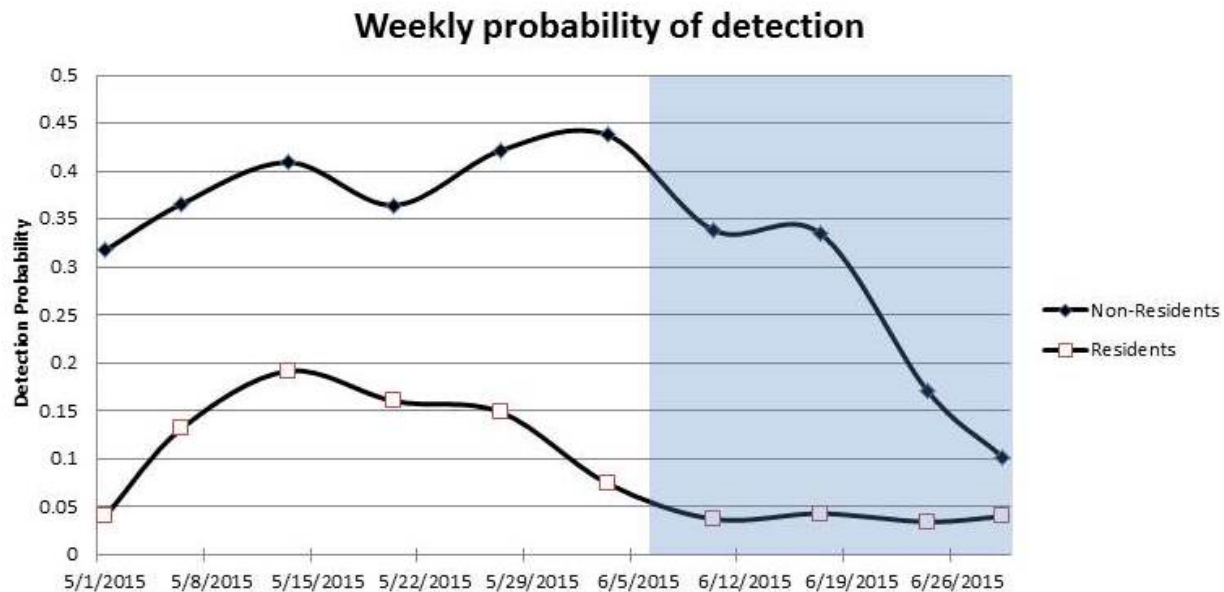
As part of my internship, I was able to go on orientation trips that highlighted a lot of special places on the Kenai Peninsula. In Homer, I sampled the cuisine and unique shops along the Spit. I got to visit the Soldotna Visitor Center and learned some cool facts. On the orientation trip to Seward, we went on a Kenai Fjords Tour and I was also able to visit the [Kenai Fjords National Park](#) Visitor's Center. In Anchor Point, I was able to look out and see the different volcanoes—that was quite an experience!

All in all, this has thus far been the best summer of my life. It was part vacation and part work. I'm so grateful to have had this opportunity. I hope to return to Alaska sooner than later.

William Moore was a volunteer with the Student Conservation Association from May to August. After his internship was completed with the Kenai National Wildlife Refuge, he returned to Oklahoma to continue his education at Langston University. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

A summer of birdsong

by Mariah Stephens



Contrasting when songbirds were singing this spring on the Kenai National Wildlife Refuge with the 3-week period (in blue) recommended for bird surveys in southcentral Alaska.

The early bird catches the worm they always say, but what if you want to catch the bird? You get up even earlier. Hiking through the woods at 3 a.m., my excitement was only slightly marred by the exhaustion of getting up so early. It was about a 30 minute hike and the rising sun had met us just as we reached the plot. On this fine morning (quickly warming up with no wind) in the last week of June, I was going to experience my first ever Breeding Bird Survey.

Thinking I would hear more birdsong out in the field than I would all summer I was eager to get started. However, not long into the survey, I realized this was going to be a slow day. There were few species singing: an American Robin here, a Dark-eyed Junco there, with a Ruby-crowned Kinglet or Yellow-rumped Warbler sometimes calling in-between. As the morning went on we did hear quite a few more species but not in the volume that we had expected.

Jump back a few months to the middle of April, after the relatively mild winter and warm spring this year, biologists at the Kenai National Wildlife Refuge

began to notice several species arriving and singing their nuptial songs much sooner than expected. This led to the question of whether or not birders and biologists would be able to catch the peak of the season if bird populations were surveyed in the last three weeks of June when they have been historically conducted.

That's where I—a biology intern from Oregon State University—came in. With the help of Supervisory biologist John Morton I designed a pilot study to see if there has been a shift in the sampling window to catch the peak of the breeding season.

I set up a Wildlife Acoustics Song Meter (SM2) in a mature spruce and birch forest, adjacent to a black spruce wetland on Headquarters Lake within the Kenai Refuge. The SM2 is an acoustic recorder made especially for bird songs. I set it to record for one minute intervals every fifteen minutes between the hours of 4 and 10 a.m. There were a total of 25 opportunities each morning for a species to be recorded. The SM2 was deployed on April 30 and then retrieved on June 30.



The Yellow-rumped Warbler was one of seven bird species examined in detail as part of this pilot study (photo courtesy of Doug Lloyd).

The SM2 recorded 24 species of songbirds, and we collected enough data on seven of those species to examine the frequency of their singing. Early on in the transcription, I began to notice that there was a high volume of birdsong a lot sooner than expected. Of course, resident songbirds generally start nuptial singing earlier in the spring than migrant songbirds. So I categorized Common Redpoll and Pine Siskin as resident breeders, and Dark-eyed Junco, Varied Thrush, Ruby-crowned Kinglet, Yellow-rumped Warbler, and Swainson's Thrush as nonresident breeders (migrants). I then averaged the frequency with which they called during their 25 sampling windows each day, a measure of their detectability, and graphed it

(see figure).

For resident species, the best time to survey was the last two weeks in May. For non-residents, the best time to survey was the last week in May and first week in June. The combined window was around the last week in May, suggesting there has been more than a two week shift in the window of optimal detectability of songbird species on the Kenai Peninsula.

Population estimates of birds surveyed during the last three weeks in June would be based on 31% and 61% lower song detectability of resident species and non-resident species, respectively, than if they had been surveyed earlier in the spring. What this means in real terms is that had we been surveying birds this year during the usual late June period, our data would have shown a significant decline in bird populations when, in fact, it was just a change in breeding phenology.

Could this have been an anomalous year simply because it was so freakishly warm? Maybe, but eBird (<http://www.ebird.org>) records for the Kenai Peninsula since 2007 indicate earlier arrival records for 33 migratory species, and later departure records for 38 species.

Refuge biologists aren't quite ready to change their bird survey protocols based on my pilot study. But the results confirm what they've been suspicious of for a while. The climate is changing and the very methods used to detect wildlife responses to that change need to be re-examined.

The early bird catches the worm but to catch the bird you must get up even earlier—this year it was two weeks earlier but what will next year bring?

Mariah Stephens was an undergraduate intern with the biology program this summer at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

The Kenai isthmus is a management conundrum

by John Morton



The invasive white sweetclover spreads down the Seward Highway towards the 10-mile wide isthmus at Portage that separates the Kenai Peninsula from the Anchorage area (Photo credit: John Morton).

The Kenai Peninsula is a big chunk of land. With more than 6 million acres, it's about the size of Belgium or Maryland. You could almost forget it's a peninsula jutting out into the Gulf of Alaska except that the drive around Turnagain Arm is a frequent reminder that the Kenai is ALMOST separated from the adjacent mainland by a once-glacial-valley now filled by saltwater. But other than adding perhaps another hour onto our drive to Anchorage, and yet another incredible opportunity to see mountain goat and Dall sheep mixing it up at sea level within sight of frolicking belugas even as the surf-able bore tide rolls through, it really just amounts to an inconvenience for most of us.

But that isthmus that separates mainland Alaska from the Kenai Peninsula is more than a minor inconvenience in the natural world. Isthmus, a word derived from ancient Greek, literally means "narrow passage or narrow neck of land." At only 10 miles wide, the

Kenai isthmus is indeed narrow, straddling the waters of Prince William Sound and the Cook Inlet between Portage and Whittier. It was likely completely covered by glaciers until about 16,000 years ago, and then became mostly ice free 7,000 years ago, of which the rapidly receding Portage Glacier is all that remains.

The passage was called "portage" as it was used as one for centuries by Alaskan Natives and Russians to travel across the isthmus. I read one account that it was used by miners around the time of the 1898 Gold Rush to reach Sunrise City on the Kenai Peninsula.

Now, of course, that same isthmus is partially consumed by the human footprint: the town of Whittier, the linear corridors of the Sterling Highway and Alaska Railroad, and the Alaska Wildlife Conservation Center, Begich-Boggs Visitor Center, and the Forest Service campgrounds and trails along Portage Glacier Road. All of these wonderful facilities for people mean

it's just a bit narrower strip of undeveloped land than nature left behind after the glaciers receded.

For some wildlife this is a big deal. The isthmus can serve as a geographic bottleneck, reducing immigration onto, and emigration off of, the Kenai Peninsula. Over time, genetic diversity can be reduced, leading to inbreeding at low populations and general concern about the ability of populations to respond to environmental stressors such as novel diseases or rapid climate warming.

A research paper published just this year in the journal *Alces*, coauthored by Thomas McDonough and Sean Farley, two local biologists from the Alaska Department of Fish and Game, showed that genetic diversity of moose on the Kenai Peninsula is 18 percent lower than that of moose in the Anchorage area. Another paper published in the *Canadian Journal of Zoology* in 2008 showed that brown bears on the Kenai Peninsula have lower genetic diversity (as measured by mitochondrial DNA haplotypes) than most other brown bear populations in Alaska. A third paper in the *Journal of Mammology* in 2005 also showed low haplotype and nucleotide diversity in wolverines from the Kenai Peninsula when compared to populations elsewhere in North America.



Wolverines (as well as moose and brown bears) on the Kenai Peninsula show reduced genetic diversity, likely because our populations are geographically isolated from the adjacent Alaska mainland (Photo credit: Marcus Mueller).

At the end of the day, it doesn't mean that these species are in imminent threat of extinction from the Kenai Peninsula. But lower genetic diversity does suggest we need to appreciate that our populations are more vulnerable and so they should be managed more conservatively than larger populations with higher gene flow on the mainland. It also suggests that we give some thought to ensuring that the isthmus is managed in a way that retains landscape connectivity to ensure movement (and gene flow) between the mainland and peninsula.

But here's the rub. However much the isthmus may reduce migration and dispersal of some native wildlife species, particularly mammals, the highway and railroad that runs the length of the isthmus also serve as vectors to introduce exotic and invasive plants to the Kenai Peninsula.

Over successive years, I've watched as first dandelions, then oxeye daisy, then butter and eggs, then birdsfoot trefoil, then orange hawkweed, and lastly fall dandelion have migrated south down the Seward Highway. White sweetclover seems to have taken an alternative route and skipped from Turnagain Arm via the rail to the Seward Depot. We treat these weeds when they eventually arrive on the borders of the Kenai National Wildlife Refuge but, by then, it's too late to prevent them from spreading throughout the peninsula.

So the isthmus needs to be managed as the double-edge sword that it is. Maintain a contiguous green infrastructure to ensure wildlife movement, but manage the heck out of the contiguous gray infrastructure (highway and rail) to ensure that even more invasives don't make their way down from the big city and port of Anchorage, where half of Alaskans call home.

Perhaps this problem deserves the attention of an interagency, multi-stakeholder group that can work to coordinate future development and weed management on the isthmus in a smart and thoughtful way. In this instance, a little planning can go a long way towards keeping our wildlife and their habitats healthy.

Dr. John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

On-line citizen science: making your interests count

by Matt Bowser



A tiny seed clam (Pisidium sp.) from Headquarters Lake was identified using a LifeScanner DNA barcoding kit (observation record: <http://bit.ly/1XiwoKa>).

Many of us who spend time on the Kenai Peninsula have to some extent been drawn by our love of nature. Midsummer traffic slow-downs at seemingly every big, hairy creature demonstrate our desire to document and share about the natural world through photographs and, more recently, via social media.

I encourage you to feed this desire to know about and share your discoveries. The venues for learning, documenting, and sharing have become ever more convenient, informative, and useful.

Birders were some of the earliest to take this kind of hobby online with ebird (<http://www.ebird.org/>), a hub where bird sightings, photographs, and checklists are shared among the birding (and science) community. Sightings are reviewed by local experts and become publicly available so that anyone can see where and when to see birds locally. A free app for iOS, eBird Mobile, makes it even easier and more convenient to record avian observations as they happen.

My favorite resource of this genre is iNaturalist (<http://www.inaturalist.org/>), which accommodates photos, sounds, and observations of basically any living thing. Observations are reviewed by the community, improving their quality and facilitating a social media dimension where members follow, comment on, and learn from each other's contributions. A

free iNaturalist app is available for both iOS and Android platforms, enabling users to easily add their observations from anywhere.

On the science fiction end of the spectrum is LifeScanner (<http://www.lifescanner.net/>), a consumer-ready kit designed to enable identifications of just about any animal by sequencing a small portion of its DNA. Each \$35 kit includes four small vials filled with a non-toxic DNA preservation fluid. Collected samples are mailed to a DNA sequencing facility and soon the identifications appear on the user's mobile device via the free LifeScanner app for iOS.

These DNA-based identifications open wide the possibilities of learning about those hard-to-know creatures like insects, worms, marine invertebrates, and other animals for which photographs are usually inadequate for identifications. After trying out a kit myself (results: <http://bit.ly/1OGNkcE>), I ordered LifeScanner kits for my children to teach them about DNA sequencing as a homeschool science project.

Though seemingly old-fashioned compared to LifeScanner, actually collecting specimens remains the most verifiable and often the most informative method of learning about living things. For example, we now have a good knowledge of the Alaskan butterfly fauna thanks to the efforts of Ken Philip and more than 400 volunteers who collected over 100,000 butterfly specimens. You can send insect and spider specimens to the University of Alaska Museum entomology collection (donations: <http://bit.ly/1M7d2jW>), where the data will be made available through Arctos (<http://arctos.database.museum/>). A permit may be required for collecting specimens on the Kenai National Wildlife Refuge.

As interesting, educational, and rewarding as these citizen science resources can be for the individual, these efforts become much more meaningful when the data are shared broadly and used. The community science examples I gave above (ebird, iNaturalist, LifeScanner and Arctos) all contribute expert-vetted data to The Global Biodiversity Information Facility (<http://www.gbif.org/>), the go-to website for worldwide species distribution data.

When people view maps of species occurrence via

websites like the Encyclopedia of Life (<http://www.eol.org/>), observations by members of the public are displayed as dots on the maps, often with opportunities for anyone to learn more through links leading to the original observations.

Here at the Kenai Refuge, our biologists tap these data for accomplishing our conservation goals. Congress mandated that the Refuge “conserve fish and wildlife populations and habitats in their natural diversity,” which specifically included insects and other invertebrates. Toward this end, we maintain a checklist of the living things that occur on the Refuge, currently 1,865 species including 34 mammals, 154 birds, one amphibian, 20 fish, 629 invertebrates, 673 plants, and 354 fungi.

Please have a look at this list on our website (<http://1.usa.gov/1RUstRs>) and check out a more interactive but less exhaustive list on iNaturalist.org (<http://bit.ly/1XibiME>). I invite you to add species to our checklist. Everyone’s input is needed to help make this list as truthful as possible. Please contact me if you find an error or a questionable record in our checklist.

Many of you are already out and about photographing and sharing the wonders of the natural world that you encounter. I personally offer a small prize (a bottle of sparkling apple cider?) if you can be the first to provide good photo-documentation of either of two species growing on the Kenai Refuge. The first should be relatively easy. Ostrich ferns grow in Homer, Nikiski, and the Kenai Mountains even as close to the Refuge as the Forest Service side of the Russian River. With leaves up to about 4 feet long, this is one of our largest, most conspicuous ferns. The second is moschatel, a charming but easily-overlooked understory plant known locally from Nikiski, Ninilchik, and Homer. Both of these plant species likely live on the Refuge but have yet to be documented within its boundaries.

I ask you to take the next step and post your ob-

servations of these two species or any others you find in ways that will benefit the broader science and conservation communities, as well as the subjects of your photos.

Matt Bowser serves as Entomologist at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.



Ostrich ferns likely occur, but have yet to be documented, on the Kenai National Wildlife Refuge. It grows abundantly in Nikiski where NRCS botanist Dorothy Wallace-Senft stood adjacent to a stand in 2002 for scale (observation record: <http://bit.ly/1Km72PI>).

Upcoming fall free events at Kenai National Wildlife Refuge Visitor Center

by Candace Ward



Enjoy the wilderness adventure film Arctic Son: Fulfilling the Dream on Saturday, November 7 with filmmakers Tom Irons & Jeannie Aspen from Homer. (Photo courtesy of Tom Irons & Jeannie Aspen)

October marks the 6 month anniversary of the new Kenai National Wildlife Refuge Visitor Center. To celebrate, we are hosting a series of three special free events over the next three Saturday afternoons.

On Halloween, October 31 from noon to 4 PM join us for “Spooky Seasons.” Visitors of all ages will enjoy learning about “not so scary creatures”—owls, bats, spiders and much more! Our Visitor Center Multi-Purpose Room will be set up with a variety of learning stations, activities and crafts that help us learn about the true role in nature of these sometimes maligned creatures. The event is set up as a drop-in and people

can spend as much or little time as they would like. This event gives us a different type Halloween “treat” based on a natural rather than sugar “high.”

On Saturday, November 7 at 1 PM, Jean Aspen and Tom Irons, film makers from Homer, will present a free special showing of their film, *Arctic Son: Fulfilling the Dream*. Jeannie and Tom share their story of moving to Alaska’s remote Brooks Range in the spring of 1992 with their 6-year-old son, Luke, and friend Laurie Schacht. Living alone for more than a year, they had the energy and insight to keep journals and to film building a cabin and recording their day to day

lifestyle in this remote wilderness. For over 20 years, they still continue to spend each summer at this very special wilderness cabin site.

After the film, they will answer questions about their wilderness life experiences. Jeannie will be available to sign her books—*Arctic Daughter: A Wilderness Journey* which recounts her youth in the wilds of the Brooks Range as well as *Arctic Son: Fulfilling the Dream*, the book the film we are showing is based on. Their books and DVD's will be available for purchase and signing. There will be special discounts on purchases of books and DVD's with proceeds supporting the Refuge's nature education programs.

On Saturday, November 14 at 1 PM, Ranger Leah Eskelin leads her ever popular Fall Photo Safari. Participants roam the outdoors with digital cameras provided by the Refuge and capture nature images that inspire them. All ages are welcome and it is always fun to see the variety and creativity of everyone's "shots."

So please join us for fall fun at the new Kenai National Wildlife Refuge Visitor Center!

Candace Ward is a park ranger who has worked in the Refuge's Visitor Services Program for over 30 years. She is excited to share nature programs at the new Kenai NWR Visitor Center. For more information contact the Visitor Center, Tuesdays–Saturdays, 10 AM–5 PM, at 260-2820.



Kids come join us on Saturdays for "Spooky Seasons" on October 31 and a "Fall Digital Camera Safari" on November 14. (Photo by Refuge staff)

Local seashells provide more than just a home for hermit crabs

by Jennifer Peura



Gastropod shells collected near St. Lawrence Island were studied to assess if their populations affected hermit crab populations.

After beachcombing at low tide, perchance coinciding with a full or new moon to maximize your success, be it at Captain Cook State Park or Homer's Bishop's Beach, you're likely to end up with a small collection of shells, crab exoskeletons, or other remnants of marine life. Even without regard to the actual animals whose exoskeleton remains are now simply just seashells that adorn the mantle in your living room, the shells themselves have other ecological values.

The breakdown of shells provides nutrients for organisms that live in the ocean's benthos (or bottom). This nutrient recycling is integral to the availability

of calcium carbonate, the major compound in shells, coral, the exoskeleton of lobsters and crabs, and (importantly to Sockeye lovers) pteropods. Pteropods are the major food source of krill, which in turn is the major food source for juvenile salmon. Sea shells also provide habitats for multiple fish species at different stages in their life cycle, notably to hide from predation. Shells are used by shorebirds to build nests, by barnacles as a substrate to grow on, and by hermit crabs for protection.

The lowly hermit crab you might purchase from PetCo is often assumed to be a textbook example of one species that can't exist without another in close

proximity. That is to say, as a responsible hermit crab owner, your aquarium should hold gastropod (slugs, snails, whelks and periwinkles) shells of various sizes that your growing pet crustacean can use as disposable houses.

So you might think that hermit crab populations are dependent on gastropod populations. It turns out that's not the case. As a graduate student at Southern Illinois University, I studied exactly that question by examining populations of hermit crabs and gastropods sampled at 52 sites around St. Lawrence Island with a trawl net by the U.S. Coast Guard's icebreaker Healy. Although I tortured the data collected from the 10,000-square-mile study area with lots of different analyses, I couldn't find any evidence to support the commonly held idea that hermit crab populations are geographically limited by gastropods. Further research is needed to explain how gastropod shells were available to hermit crabs without the living gastropods being present, even after accounting for migration by populations elsewhere—a mystery that remains unanswered.

Closer to home, there is another mysterious issue that plucks hard on the heart strings of those who remember Clam Gulch, just a few years ago, playing host to a heavy flow of Alaskans setting up shop with clam cannons and buckets full of razor clams. During the past two years, however, the abundance of razor clams has been shockingly low. The rapid population decline resulted in suspending all clamming activity from the mouth of the Kenai River to Homer in hopes that we set up future generations with a successful clam fishery.

The question of “where are the clams?” reaches beyond our Kenai Peninsula beaches. The same question is being asked in every state along the Pacific and Atlantic oceans. Clam fisheries are abruptly declining, causing those whose livelihood depends on a responsibly maintained clam fishery to desperately search for an answer and a solution. The Boston Clamdigger's Association filed a lawsuit against Swissport, a company that provides Boston Logan International Airport with fuel. The lawsuit claims that the loss of harvestable clams in Boston Harbor was influenced by a huge fuel spill in 2010. Clams and other bivalves (mussels, oysters and scallops) filter water for movement

and to acquire food, making bivalves sensitive to toxins even as they serve as a vector for humans to ingest toxins.

Unfortunately the same issue is true for the once lucrative fisheries of Long Island and Hudson Bay. After Hurricane Sandy, 76 clambers filed a lawsuit against the City of New York claiming wastewater from a treatment facility that lost power contaminated their fishery. Prior to Sandy, many blamed overharvesting of clams caused the demise of that fishery, which resulted in Manhattan chowder frequently (and ironically) served with clams imported from Florida. Like many other fisheries, the impact of harvesting such a large portion wasn't considered until the population was in peril. However, is that the whole story—overfishing and pollution? There's evidence that another factor is in play as well, and it starts at the beginning of the bivalve's life cycle.

Poor larval growth and survival was first observed in oysters in 2005 with decreased fertilization rates and increased juvenile mortality due to the unavailability of calcium carbonate. Clams, crabs, lobsters and coral struggle from day one to grow because of a lack of the fundamental building block of their shells. Calcium carbonate is decreasing in marine systems, and it's due to a chemical reaction taking place in every ocean of the world. When atmospheric carbon dioxide levels rise, their concentrations in the ocean increase as well, causing a chemical reaction that makes the available carbonate less able to bind with calcium. This creates a more acidic environment with calcium carbonate levels sometimes low enough to inhibit larvae from maturing into shelled clams.

The finding of a simple seashell on a beach can be a reminder that gastropods and bivalves are both important but vulnerable to environmental change. While water treatment experimentation is underway to help clam and oyster hatcheries rebound, I try to leave the beach with a little less trash than when I arrived in hopes that my small efforts may help the plight of these shellfish.

Jen Peura is a seasonal biotech at the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Radio and GPS collars help manage moose and caribou on the Kenai

by Nate Olson



Caribou trying their best not to be counted during an aerial survey.

Opportunities to view wildlife around our neighborhoods on the Kenai Peninsula are one luxury we often take for granted. Whether it's a moose in your yard or caribou backing up traffic on Bridge Access Road, large charismatic megafauna are not uncommon sights on the Kenai. These opportunities are not without risk, as most of us know. Collisions with wildlife are always a possibility and we all need to be attentive while driving, especially as daylight dwindles.

In some instances, you may have spotted a moose or caribou along the roadside with a bright orange or white collar hanging around their neck and have asked yourself “why are they wearing such flashy and fash-

ionable attire?” The answer is wildlife management.

Radio collars have been a valuable tool for biologists for over 40 years. Biologists use radio collars to locate animals at different times of the year for a variety of reasons. As technology has progressed, manufacturers have incorporated many useful additions to the old VHF radio collar. One very useful addition has been the inclusion of GPS receivers that log location data at fixed intervals. But a shortcoming of GPS collars is that these data are stored on the collar, meaning the collar must be recovered and downloaded to retrieve the data.

Two years ago, Kenai National Wildlife Refuge bi-

ologists fitted moose with GPS collars that also have a satellite phone transmitter incorporated into the collar. This allows GPS positional information from individual animals to be sent directly to a biologist via email, allowing for real time tracking of animals. We use GPS data to track moose movement as it relates to seasonal migration and their behavior around urban centers and roadways on the Kenai Peninsula.



ADF&G Area Manager Jeff Selinger collars a caribou from the Kenai Mountain herd in 2003.

The big question is why we put collars on wildlife in the first place. In the world of ungulates, we typically only put collars on female animals as there are problems when the necks of males expand during the rut. In the case of moose, the Alaska Department of Fish and Game (ADF&G), in collaboration with the Refuge, use radio and GPS collars to track moose movement in Game Management Unit 15. There are currently 50 collared cow moose in GMU 15A, 15 in GMU 15B, and 50 in GMU 15C. We track moose daily during the peak spring calving period to determine if and when calves are born, how many calves they have and, with continued tracking through the year, calf survival and potential causes of mortality.

In the case of caribou, we primarily use collars to assist in finding animal groups to count them during aerial surveys. Last week, ADF&G and Refuge biologists used radio collars to find and count three of the four herds on the Kenai Peninsula—the Kenai Mountain, Killey River and Fox River caribou herds. Knowing herd size allows us to allocate harvest which is reflected in hunting regulations, and to monitor long term population trends. Note that all four caribou

herds on the Kenai Peninsula are the result of reintroductions in the 1960s and 1980s.

We estimate the Kenai Mountain herd (KMH) to have 200 caribou. The KMH occupies the Chickaloon River, Big Indian Creek and Resurrection Creek drainages in GMU 7. Their population has peaked out at 400 animals on two occasions (likely limited by their winter range) followed by declines. Population size is currently on the low end and so harvest quotas have been adjusted accordingly. This year, 25 drawing permits are likely to be available through the State drawing permit system and a small number of Federal Subsistence permits in the communities of Cooper Landing and Hope. Our management objectives for this herd are to maintain a post-hunt population of 300 to 400 animals. There are currently 6 radio-collared caribou in this herd with plans to deploy more collars in the spring.

The Killey River herd (KRH), which occupies the mountains between Skilak and Tustumena Glaciers, appears to be doing quite well. Recent aerial surveys indicate the herd to be around 500 caribou. The KRH grew to more than 700 in 2001 before several avalanches killed about 200 caribou. The herd has since grown steadily to current levels. Harvest opportunities are available for KRH caribou through the State drawing permit system. Currently 7 radio collars are deployed in this herd.

The Fox River herd (FRH) is the smallest herd on the Kenai Peninsula and occupies the smallest range, an area south of Tustumena Glacier between upper Fox River and Truuli Creek. The FRH has historically fluctuated between 75-100 animals, and recent aerial surveys indicate 80-90 caribou. Harvest opportunities for FRH caribou are available through the State drawing permit system. Only one radio collar is currently deployed in this herd.

The next time you see a moose or caribou in or around town take a closer look to see if they are wearing a collar. Give them a wave in appreciation of their service if they are. Those collars allow us to better understand the complexities of their lives so we can manage their populations to ensure they will be around for generations to come.

Nathan Olson is the wildlife biologist-pilot at Kenai National Wildlife Refuge. Find more information about the refuge at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Feral wildlife can be a problem

by John Morton



A Chinese ring-necked pheasant near Morgan's Landing on the Kenai River. Feral pheasants likely support a breeding population in the wild on the southern Kenai Peninsula (photo credit: K. Marlow).

A couple of weeks ago, the *Peninsula Clarion* carried a story about the Bunny Task Force, formed to deal with the 200 or so once-domesticated rabbits that are now living in the wilds around Juneau. The bunnies have gone feral, meaning they escaped or were released from captivity and are now breeding in the wild.

Pets and other domesticated animals that go feral typically become problems. In the case of bunnies, they can literally eat up the landscape. Perhaps the best example is the initial escape of captive rabbits in Australia in 1788, and then a well-meaning deliberate introduction in 1859, which set the stage for rabbits to compete with kangaroos as the primary herbivore Down Under. I read one account that 2 million rabbits were being killed annually with no appreciable dent in

their population. It got so bad that over 2,000 miles of fence were constructed in the early 1900s to try (unsuccessfully) to keep rabbits out of Western Australia.

Here in the U.S., as many as 60 million feral cats may roam the Lower 48. One published study in 2013 estimated free-ranging domestic cats may kill up to 4 billion birds, 22 billion mammals, 822 million reptiles and 300 million amphibians EACH YEAR in the U.S. Ironically, some of those mammals are rabbits, as well as mice, voles, shrews and squirrels. A University of Nebraska study from 2010 found that cats were responsible for the extinction of 33 bird species worldwide. Cats' death and destruction of native fauna is only compounded by the fact that feral cats have high infection rates of feline leukemia virus, feline immunodeficiency virus, rabies and ectoparasites like ticks

and fleas, many of which can be transmitted to wildlife (and sometimes people).

Our own Captain James Cook, namesake of the Cook Inlet, was responsible for introducing goats to Hawaii in 1778. Initially presented as gifts, the goats spread rapidly in the wild, eventually numbering 75,000 on the Big Island by 1930. In recent decades, the National Park Service and other agencies have aerial gunned feral goats in an effort to save endemic flora in spectacular places like Volcanoes and Haleakala National Parks. In 2013, federal courts even went so far as to mandate the aerial shooting of feral sheep and goats on the slopes of Mauna Kea to protect habitat of the palila, an endangered Hawaiian honeycreeper.

Closer to home, Norway rats escaped onto Rat Island, a 7000-acre island in the Aleutians, in the aftermath of a Japanese shipwreck in the 1780s. Although rats from a ship aren't really domesticated, they are considered "commensal" in that they have a living arrangement (like it or not) with humans. As rats became feral on the island, they eliminated burrowing seabirds like tufted puffins, and severely reduced populations of black oystercatchers, glaucous-winged gulls, pigeon guillemots, rock sandpipers, common eiders, red faced cormorants and gray-crowned rosy finches. A successful aerial application of rodenticide in 2008 has begun the restoration of the island's ecology even as the island's name was restored to Hawadax, the original Aleut name.

Even closer to home, there's pretty good evidence that non-native game birds have gone feral. Chinese ringed-neck pheasants, chukar, quail and turkey have been released accidentally and deliberately on the Kenai Peninsula, and at least pheasants may be breeding near Homer. As much as feral game birds may be an opportunity to go hunting, they can also

introduce avian diseases. For example, in 1999, Newcastle virus (commonly carried by poultry) was suspected of killing an entire cohort of double-crested cormorants that nest on Skilak Lake within Kenai National Wildlife Refuge.

The Alaska Department of Fish and Game tries to minimize the likelihood of feral wildlife becoming established in our wilds. Take a look at the hunting regulations and you'll see that there are no closed seasons and no harvest limits on the take of feral ferret, feral swine, or feral pheasant, chukar, quail, wild turkey and partridge (with the exception of GMU 14C).

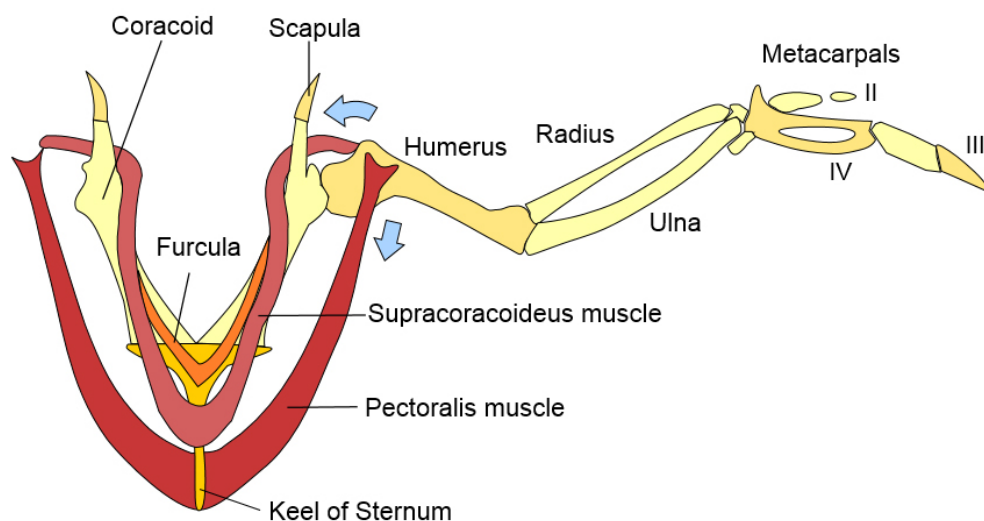
What's intriguing is how exotic plants and animals are managed differently in Alaska. The Alaska Division of Agriculture maintains a list of prohibited (14 species) and restricted (9 species) noxious weeds, and a quarantine on 5 freshwater aquatic plant species including Elodea, essentially establishing a black list. In contrast, ADF&G maintains a "clean" list of more than 44 animal taxonomic groups that may be possessed, imported, exported, bought, sold, or traded without a permit but may not be released into the wild. This list includes some strange bedfellows such as nonvenomous reptiles, African pygmy hedgehogs, one-humped camels and, ironically, some of the very species that can cause problems when released into the wild—European rabbit, European ferrets and any pheasant species.

At the end of the day, love your rabbit or eat your rabbit, but keep it penned. And the same can be said of most of our livestock, pets, and other domesticated critters—DON'T LET 'EM LOOSE, Alaska!

Dr. John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

In honor of turkeys

by John Morton



Simplified anatomy of the structural components used in bird flight. If you prefer eating white meat at Thanksgiving, you're eating the turkey's pectoralis and supracoracoideus muscles (credit: [Wikipedia](#)).

Did you know that you were not alone yesterday in eating turkey? According to the National Turkey Federation, 95 percent of Americans eat turkey on Thanksgiving, consuming 675 million pounds from 45 million birds. It certainly goes a long way towards explaining that gastric discomfort we experienced last night. Here are some facts you might not know about the biology and history of turkeys.

Carl Linnaeus, despite being the father of the modern taxonomic naming system, incorrectly named wild turkeys *Meleagris gallopavo* because he thought they were related to the African guineafowl (*Numida meleagris*).

Our domestic turkey did NOT originate from North American wild turkeys that the Pilgrims ate at their first Thanksgiving. The truly amazing story is that the Aztecs apparently domesticated the South Mexican turkey (now a critically endangered subspecies) over 2,000 years ago. Spanish conquistadors took it back to southern Europe and the Middle East in the mid sixteenth century, eventually to be introduced to the rest of Europe by traders from Turkey (one version of how it got named).

By 1601, turkeys were so common in England that Shakespeare wrote “contemplation makes a rare turkey-cock of him: how he jets under his advanced plumes” in describing someone in the comedy *Twelfth Night*. The now fully domesticated turkey circled back to the New World when English and Dutch colonists brought them to Virginia in the early seventeenth century.

Turkeys were originally domesticated for their plumage, not their meat. While Aztecs did use turkeys for meat and eggs, it was their feathers that were in demand for decoration. It wasn't until the 1900s that turkeys were selectively bred for meat production, specifically for big breasts and thighs. By the late 1930s, mature males reached 40 pounds with females weighing half that. The breast muscles are so enlarged in commercially-bred birds that tom turkeys are incapable of getting close enough to a hen to mate—they have to be bred by artificial insemination! Charles Darwin would roll over in his grave if he knew about this.

Breast muscles actually include several muscles, but the two that get the most attention are the pec-

toralis major and supracoracoideus. The pectoralis is what is typically called the breast and the supracoracoideus is the equivalent of the “chicken tenders” in turkey. In most flight-capable birds, the pectorals make up 15 to 25 percent of total body weight, but it’s commonly over 30 percent of commercially-bred turkeys.

These two muscles make flight possible. The pectoralis stretches between the wing’s humerus and keel, and is responsible for the downstroke. The supracoracoideus lies under the pectoralis and, attaching to the keel and upper side of the humerus, is responsible for the upstroke through a “rope and pulley” arrangement (see figure).

As you might imagine, it’s much easier to pull a wing up since a bird is essentially falling during flight, and so the supracoracoideus is much smaller than the pectoralis. In most songbirds, say orange-crowned warblers or gray jays that are common here on the Kenai Peninsula, the weight of the supracoracoideus is 20 percent of the pectoralis. I have to confess I’ve been waiting since I first studied ornithology in 1978 to use this factoid.

In contrast, the supracoracoideus of hummingbirds is 50 percent of their pectoralis. This beefed-up supracoracoideus is essentially what allows hummingbirds to not only hover, but actually fly backwards!

The wishbone (or furcular) is simply the fused collar bones of the turkey. It acts like a spring to maintain the symmetry of wing beats as it braces the shoulders.

And why do turkeys have white and dark meat? It has to do with myoglobin. Avian myoglobin is similar to mammalian hemoglobin except that the latter

transports oxygen in the blood while the former transports and stores oxygen in muscles—and the more myoglobin you have, the darker the meat. Well-oxygenated muscle is needed for endurance, and so migratory waterfowl have dark breast meat. In contrast, most game birds including domesticated turkeys and chickens, which don’t typically fly far, have white breast meat but dark meat in their legs as they spend a lot more time running around. In fact, commercially-bred turkeys can’t fly.

Not only does white and dark meat taste differently, but they cook at different temperatures. White meat is best at 155 degrees whereas dark meat is best at 180 degrees. So consider covering the breast with an ice pack while the rest of the bird comes to room temperature before cooking.

Lastly, many people know that Benjamin Franklin thought the wild turkey should be our national bird instead of the bald eagle. But you probably didn’t know that in a letter to his daughter, Sarah, he wrote “For in Truth the Turkey is in Comparison a much more respectable Bird, and withal a true original Native of America. He is besides, though a little vain & silly, a Bird of Courage, and would not hesitate to attack a Grenadier of the British Guards who should presume to invade his Farm Yard with a red Coat on.” Ben would also roll over in his grave if he discovered that the commercial version of this noble bird no longer flies or even reproduces on its own.

Dr. John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

The mysterious life of the vagabond cluster fly

by Matt Bowser



A male cluster fly suns on the siding of the Kenai National Wildlife Refuge headquarters building, March 23, 2015 (<http://bit.ly/1FhfuB>).

Last February through March as our snow melted away, some of early spring's most precocious invertebrates pranced in the sunshine, warming themselves on south-facing wood siding of the Kenai National Wildlife Refuge's headquarters building. Intermingling among the usual metallic green and blue flesh flies that typically awake in the early spring were many large, dark flies having a golden wooliness. These were cluster flies (genus *Pollenia*), a kind of fly that had not previously been found in Alaska (article: <http://bit.ly/1Q1iPyA>).

Worldwide, there are 196 species of cluster flies according to the [Catalogue of Life](#), all of them native to the Old World. Six of these have now become established in North America. Our cluster flies turned out to be *Pollenia vagabunda*, which means the wandering or vagabond *Pollenia*, so perhaps the "vagabond cluster fly" would be a good common name for it. Since the

first North American record of this species on the East Coast in 1958, it has spread west to British Columbia and now southcentral Alaska.

Cluster flies get their name from their habit of gathering in dense aggregations in and on man-made structures from late fall to early spring, where they can be a serious nuisance simply because there are so many of them. Pest control techs can do a brisk business in response to sometimes remarkable numbers of flies reminiscent of the Biblical plagues. Now you can even buy Cluster Buster™ traps specifically designed to trap and kill these flies.

Thankfully, cluster flies really are no more than a nuisance to humans. They apparently end up in and on buildings only when seeking a cozy spot to spend the winter or when gathering at a sunny perch to warm up and meet potential mates on a nice spring day. The rest of the life of a cluster fly is more interesting and myste-

rious, blurring the line between parasite and predator.

We only know the life of one cluster fly well. Females of *Pollenia rudis*, after mating in the spring, lay their eggs on the soil surface. Soon the eggs hatch and the tiny maggots dive down into the soil. Weak burrowers, they must exploit pre-existing passages in the soil as they hunt down their quarry: a particular kind of earthworm. A successful larva will burrow into the unfortunate worm's side, then slowly eat the living host from the inside out. If its host worm dies before it is done eating, the now larger maggot behaves more like a predator than a parasite, resuming its search for a new worm to consume. Once sated, the cluster fly larva pupates in the soil, later emerging as a new adult fly.

Other species of cluster flies attack earthworms and snails, and there is evidence that some cluster flies may go after certain insect larvae in the soil. For most cluster flies, including the vagabond cluster fly that now lives with us here, we do not know who they are hunting.

It could be that our cluster flies eat earthworms. If this is true, then we would now have an exotic fly feeding on exotic worms, a completely imported parasite-host or predator-prey system! Worms infected by cluster fly larvae are quite conspicuous, so I checked worm specimens in the Refuge's collection and freshly-caught earthworms from around the head-

quarters building. I found no cluster fly larvae.

Perhaps I did not check enough worms or maybe our cluster flies eat snails, slugs, insects, or something else. As a new and at least locally abundant member of our fauna on the Kenai, cluster flies certainly affect something out there, but figuring this out could be a real challenge. Have you ever tried to follow a fly to learn its secret life?

There is a new, high-tech method designed specifically to solve this genre of mysteries. Termed MAPL (molecular analysis of parasitoid linkages), the technique relies on small amounts of host DNA from food eaten as a larva lingering in the digestive tract of the adult insect. By selectively targeting and sequencing DNA from the host, researchers have been able to find previously unknown host-parasite and predator-prey relationships.

However it is done, I would very much like to learn the enigmatic details of the life of the vagabond cluster fly. This would be relevant not just here on the Kenai, but also in much of Canada, the northern tier of the lower '48, and northern Europe, where *Pollenia vagabunda* is an abundant and seasonally annoying nuisance.

Matt Bowser serves as Entomologist at the Kenai National Wildlife Refuge. You can find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Fire in the winter

by Mike Hill



A fire fighter from the Kenai National Wildlife Refuge uses heavy machinery recently to reduce fuel loads at the Moose Research Center (credit: Nathan Perrine, KENWR)

As the new Assistant Fire Management Officer at the Kenai National Wildlife Refuge, many people ask what exactly my job entails. At least nine months of the year, my efforts are focused on wildland fuels treatments, in which we manipulate vegetation in specific areas so as to minimize the risk of wildfire impacts to communities, refuge infrastructure, and other resources found within and adjacent to refuge lands.

So what are those fuels treatments? The Refuge has several treatments identified for the next 5 years. These treatments vary in shape, size and location. Anyone who has lived on the Kenai Peninsula during the last two summers probably now realizes how important it is to be “FireWise”—preparing your home, property, and surroundings in a way that can withstand a wildfire, or provide firefighters the advantage

during firefighting efforts.

Fuels treatments implemented on the Refuge are a way to “FireWise” refuge lands by lessening the threat of a fire that wants to move off the Refuge onto private or other lands. Kenai Refuge spent 15 years planning and implementing the shaded fuel treatment along Funny River Road, the one that ultimately helped firefighters take a stand against the Funny River Fire. This treatment was well worth the investment as it helped save thousands of homes and millions of dollars’ worth of private property and infrastructure. The effectiveness of these refuge treatments can be enhanced if they are complemented by fuel reductions on private land.

What do fire managers do in the winter? Winter is our busy time to get ready for the next fire season. This is when we make changes based on lessons learned and put those into practice during planning. Winter is also a great time to implement treatments. We can take advantage of the frozen ground and use heavy equipment to manipulate fuels without the risk of damaging surface vegetation while reducing potential impacts to wetlands and wildlife. The problem with using equipment later in the spring and summer is that the risk of sparking a fire increases then.

What about the risk of wildlife disturbance? While we can never fully mitigate this, we can reduce those impacts by doing our work in the winter when the seasonal residents of the Kenai Peninsula (migratory birds) are not here breeding and nesting. This is especially true for ground nesting birds like juncos and resident spruce grouse.

We can also take advantage of the high moisture in fall and winter to safely ignite slash piles that were created from fuels treatments. Usually these piles contain smaller sized branches and wood left over from the thinning, limbing, and bucking of fuels within the treatment area. Burning piles while snow is on the ground is the best way to dispose of those excess fuels while reducing the risk of the fire escaping.

As we near the shortest day of the year, it seems odd to consider fire danger, but winter is also a great time to limb trees and clear brush to increase the defensibility of your home. Next time you’re driving north out of Soldotna, take a close look at the sign in

front of the Kenai/Kodiak Forestry Office. It doesn't say "Fire Danger is Low Today"—no, of course fire danger is low in the winter—it says "Firewise Your Property"!!! What a great message! Home and land owners who live in that transition area we call the Wildland Urban Interface absolutely need to be proactive in protecting their property from wildfire.

Kenai National Wildlife Refuge will continue to do its part too by designing and implementing fuels treatments along our boundary to lower the risk of a wildfire coming off of the Refuge and onto private land. Wildlife benefits are also considered when designing these treatments. Our fire program is focused on protecting communities, providing information, and utilizing fire as a natural process on the landscape.

My family and I have felt so welcomed by, and are delighted to be a part of, the central Kenai Peninsula. Arriving in August, we've discovered the unique beauty of this place. I encourage all residents from private land owners to public land managers to maintain this beauty and make it better where we can. Fuels treatments themselves are not all that glamorous to look at, but it's what they represent and how they function that will help maintain this landscape for our current and future generations.

Mike Hill is the new Assistant Fire Management Officer the Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

Public use cabins a legacy of retiring refuge ranger

by Candace Ward



Ranger Gary Titus (left) with Brian Taylor and Ivan Sjodin after restoring the 1920s era sauna at the Moose Creek Cabin on the shores of Tustumena Lake. Gary leaves a legacy of a vibrant cabin management program after 15 years of service at the Kenai National Wildlife Refuge.

Have you ever stayed at a Kenai National Wildlife Refuge cabin enjoying the beauty and peace of nature? Or browsed the historic Elwell and Andrew Berg Cabins at the Refuge Visitor Center Complex? Do you ever wonder how these cabins came to be?

Well, these recreation and historical education cabins are the visionary legacy of Park Ranger Gary Titus, who retires on December 31, 2015 after 15 years of service to Kenai Refuge. Since 2000, Gary has spearheaded a comprehensive program to restore, preserve,

and interpret Refuge historic cabins. The Refuge Cabin Management Program that Gary has developed maintains 24 cabins, of which 16 are available for overnight stays by locals and visitors alike, and the remaining are preserved for historical interpretation purposes and can be visited for viewing.

Fourteen of the 16 cabins can be conveniently reserved online at <http://www.recreation.gov>—the other two are available on a “first come, first serve” basis. Fees generated from cabin reservations go directly

back into maintaining and improving the cabins. Over the years, Gary has supervised cabin crews, Youth Conservation Corps (YCC), Kenaitze youth, and community volunteers in the careful restoration of Refuge historic cabins and, also, in the construction of new log cabins for public use.

Prior to Gary's arrival at the Refuge in 2000, the historic cabins were in a highly degraded state and suffered a high incidence of vandalism. Through Gary's efforts, the Refuge has noted a growing stewardship ethic by local residents and visitors for these important cultural resources. We have Gary to thank for this "sea change" through his dedication and tireless efforts to create and maintain a first-rate Cabin Management Program at Kenai Refuge.

Gary has reached beyond the Refuge to assist in local community historical preservation projects at the Kasilof Historical Society and with the Kenaitze Tribe at the K'Beq interpretive site near the Russian River. His expertise is in great demand and he has been recruited to lead teams in historic structure restoration for the Alaska Department of Natural Resources, U.S. Forest Service, Bureau of Land Management, and National Wildlife Refuges in the Lower 48.

Gary was instrumental in creating a training course, "Stabilization and Preservation Techniques for Historic Log Structures" to help train others in accomplishing restoration work. Using historically appropriate hand tools and techniques, Gary demonstrated and taught his students a high degree of technical expertise in restoration work. The end goal is that their projects will exactly restore historical structures to the original way their builders made them—right down to axe marks on the replacement logs.

Gary not only is a "hands on" project guy, he is also a dedicated researcher and writer. Gary has registered over 100 historic cabin and cabin sites with the State of Alaska's Office of History and Archeology. Two cabins are now listed in the National Registry of Historic Places thanks to Gary's efforts. He has catalogued al-

most 500 historic artifacts ranging from miner's tools to antlers from our endemic (and now extinct) woodland caribou to a Kenaitze skin scraper found on Caribou Island. He has also catalogued more than 10,000 historic photos of the Kenai Refuge and Peninsula.

He has a passion for the history of the Big Game Guide Era in Alaska circa 1880–1940. Gary wrote and published a book with Catherine Cassidy entitled *Alaska's No. 1 Guide: The History and Journals of Andrew Berg, 1869–1939*. He has other writing projects in the works that will keep him busy in retirement and that we can look forward to reading in the future.

And if that's not enough, Gary was a commissioned Federal law enforcement officer for the first 12 years of his tenure with the U.S. Fish and Wildlife Service.

Ranger Gary Titus was honored for his work in 2013 as the winner of the Alaska Region's U.S. Fish and Wildlife Service's Sense of Wonder Award. Gary was recognized for his outstanding achievement in the field of historical interpretation and preservation. The award recognized Gary's ability to foster a sense of wonder and stewardship for the historic heritage of Kenai National Wildlife Refuge.

Gary looks forward to a rewarding retirement at his remote cabin in the Twin Lakes country across Cook Inlet where he enjoys wildlife observation, fishing, hunting, and exploring the outdoors by foot, ski and boat. Gary not only will find life better at his cabin retreat, but can retire with the thanks of countless people who have felt the same way during their cabin stays on Kenai Refuge. "Life is truly better at the cabin."

Park Ranger Candace Ward has managed the Information & Education Program at Kenai National Wildlife Refuge for over 30 years. She is honored to be Gary Titus' colleague for the last 15 years. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.

How the Capitol Christmas Tree was named

by John Morton



This year's Capitol Christmas Tree in Washington D.C. is a Lutz spruce from Primrose on the Kenai Peninsula (photo credit: Architect of the Capitol).

On this Christmas Eve, most of us have an ornamented tree of one sort or another in our house, a tradition that goes back at least to the 1500s in Europe and one that was firmly established in most U.S. households by 1920. Most of us also know that Alaska provided the Capitol Christmas Tree that stands outside the White House, a gift from the Chugach National Forest and celebrated in the essay by fifth-grader Anna DeVold from Soldotna. What an incredible story and what an incredible tree! A more than 90-year-old, 74-foot, giant Lutz spruce—a what?!

Designating the Capitol Christmas Tree has been a formal process since 1964 and, beginning in 1970, these trees have all originated from our National Forests. In the last 51 years, there have been 2 white pines, 19 firs

representing 8 species, and 30 spruce representing 8 species. This year's Capitol Christmas Tree is the first from Alaska and the first Lutz spruce.

Lutz spruce is the natural hybrid between Sitka (*Picea sitchensis*) and white spruce (*Picea glauca*). Sitka spruce grows in our coastal rainforest from the eastern Kenai Peninsula to northern California, preferring a maritime climate with moderate temperatures and lots of rain. White spruce grows from the western Kenai Peninsula across Interior Alaska to Newfoundland, preferring a continental climate with extreme temperatures and low precipitation.

Here on the Kenai Peninsula, the rainshadow created by the Kenai Mountains creates unique climate variations where cooler temperatures intersect with moderate rainfall. You can find this microclimate along the Resurrection Trail, sections of the Seward Highway and in Caribou Hills. In the summers of 1950 and 1951, Harold John Lutz collected specimens from Jerome and Kenai Lakes near Cooper Landing that he recognized as a hybrid between the two spruce species. These specimens were subsequently confirmed as a hybrid by Elbert Little of the U.S. Forest Service in 1953, who formally named it "*Picea × lutzii*" in honor of Lutz.

Who was Lutz? He didn't just stumble across this conifer and take a lucky guess as to its taxonomy. Dr. Lutz was a professor in the Yale School of Forestry from 1933 to 1968. Early in his career he conducted research for the U.S. Forest Service in Alaska.

Lutz spruce is of interest here on the Kenai because it appears to be more susceptible to mortality from a spruce bark beetle attack than either parental species. Dr. John Alden, a retired forest geneticist still affiliated with the University of Alaska Fairbanks, studied Lutz and its distribution here on the Kenai. He remains convinced that most of the forest that experienced 100% mortality in the Caribou Hills from Homer to Ninilchik as a result of the spruce bark beetle epidemic during the late 1980s and 1990s was Lutz spruce.

Alden developed a method for classifying the degree of introgression (or hybridization) based on foliage and cone characteristics on a scale from 1 (white) to 7 (Sitka). Forest Service experts used this classi-

fication to determine that the tree cut near Primrose off the Seward Highway, now standing in Washington D.C., was indeed a Lutz spruce, scoring a 5 or 6.



Professor Harold J. Lutz, standing (back row, left) among Yale School of Forestry colleagues in 1936, was the first to recognize the hybrid spruce that bears his name from specimens he collected near Cooper Landing (photo credit: Yale University Library).

Dr. Rob DeVelice, one of the taxonomic experts consulted, was also one of the individuals involved in identifying 28 species of lichens that grew on this particular tree—a tree that was likely just sprouting as the tracks for the nascent Alaska Railroad, half a mile away, were being laid between Seward and Turnagain Arm in the early 1900s. It is truly amazing that a single tree can harbor this much biodiversity.

Wade Wahrenbrock, Kenai Peninsula Borough forester, tells me that Lutz spruce from the Kenai Peninsula has been widely used as stock to grow forests in Iceland, of all places! Whether it's the similarity of the climate or soils between our peninsula and their island, our native Lutz has been a founding species in Iceland's decades-old efforts to afforest its otherwise stark landscape.

Enjoy your family and gifts this Christmas—but give some thought to the tree that stands in your house and the giant Lutz that was trucked 4,000 miles to represent Alaska and the Kenai this holiday.

Dr. John Morton is the supervisory biologist at Kenai National Wildlife Refuge. Find more information at <http://www.fws.gov/refuge/kenai/> or <http://www.facebook.com/kenainationalwildliferefuge>.